ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

APRIL 1951

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FOUNDED 1866

For All Mines — Large or Small . . .

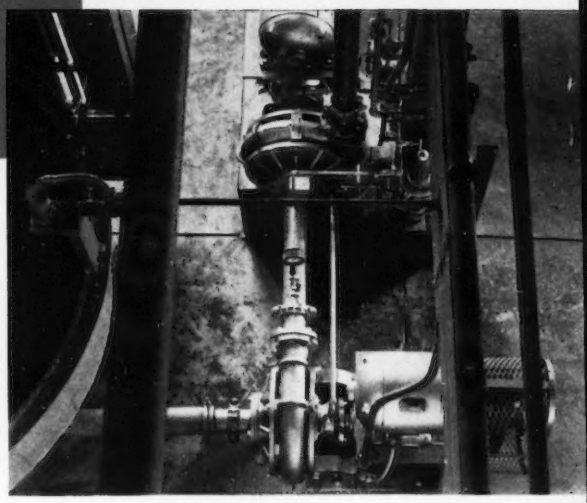
Better Mining Through Better Management

How One Mine Staff Successfully:

- Cuts Labor Costs Per Ton
- Increases Productivity
- Decreases Absenteeism
- Turns Potential Losses Into Profits

A Special 32-Page Section Beginning On P. 71

HYDROSEAL PRE-ENGINEERING pays off



Two B-Frame Hydroseals in series in tailing system

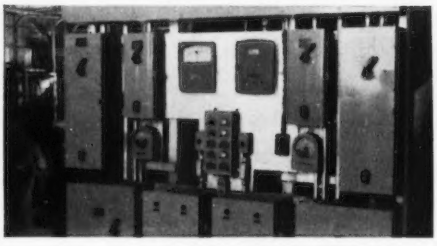
Tailings disposal is one of the big jobs in your mill that you can do better with a pre-engineered Hydroseal system. Like the men at this new lead-zinc flotation mill in the Southwest, you'll find that it pays to invest in pumps that almost think for themselves.

Here's the set-up: Two identical units are provided, which include two B-Frame Hydroseal Slurry Pumps in series under automatic speed control. A hydraulic coupling is used to secure infinite speed variation. The control point is from the liquid level in the sump. Pump speed is varied according to rate of flow to the sump and/or changes in head. The standby unit is automatically switched on if the other unit fails for any reason. To prevent clogging of the discharge line, should both motors fail, an automatic dump valve 700 feet from the mill drains the entire system.

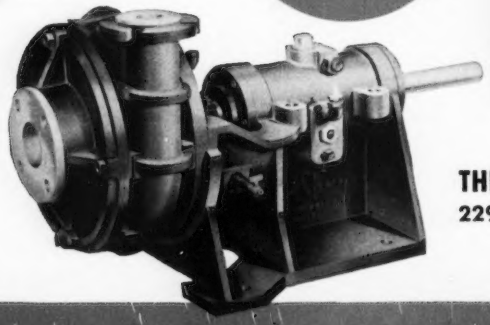
Our staff of highly skilled engineers is solving similar problems of abrasives-pumping every day in cooperation with men who want the best. They'll be glad to work with you. **Write for our new Catalog No. 850.**

Foolproof operation
Easy maintenance
Economy

See the new Hydroseal at COAL SHOW
Cleveland—May 14-17
Booth 921



Control panel of automatic tailing disposal system



THE ALLEN-SHERMAN-HOFF PUMP CO.
229 S. 15th Street • Philadelphia 2, Pa.
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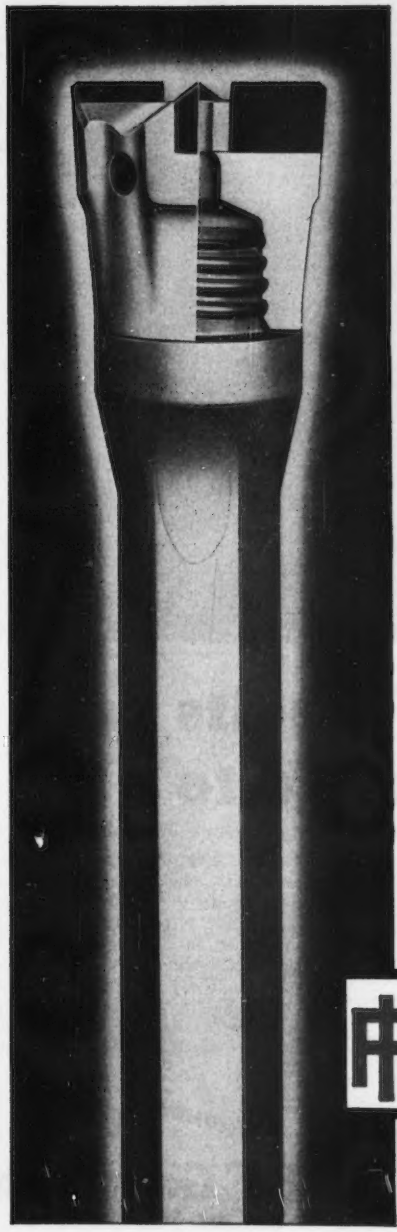
HYDROSEAL SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

HYDROSEAL, PACKLESS AND MAXIMIX DESIGNS ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD

Here's why

CARSET JACKBITS



have changed the entire concept of today's rock drilling costs

Since the advent of the Carset Jackbit, drilling costs can no longer be reckoned *only* in terms of bit cost per foot of hole. For this is only *one of many* items where Carset Jackbits have made possible tremendous over-all savings.

Check the fourteen economies listed below. Note how any one of them by itself makes a significant reduction in the cost of drilling rock. But only when you consider the cumulative effect of all these savings do you get the true picture of Carset economy. It is a picture that has already changed the entire concept of drilling costs — in mines, quarries, tunnels and construction jobs the country over.

✓ **CHECK THESE FOURTEEN SERVICE-PROVED SAVINGS! EACH ONE IS AN IMPORTANT FACTOR IN CUTTING COSTS PER TON OR YARD OF ROCK BROKEN**

1. Carset Jackbits wear longer
2. Drill faster — 50% or more
3. Boost tonnage 20% or better
4. Consume less drill steel
5. Save up to 30% on dynamite
6. Practically eliminate bit changes
7. Use longer steels
8. Eliminate tapered holes
9. Permit use of lighter drills
10. Reduce air consumption at least 40%
11. Require less shop equipment
12. Reduce maintenance costs 30% or more
13. Drill the hardest rock
14. Finish more rounds per month

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ROCK DRILLS • COMPRESSORS • AIR TOOLS • TURBO-BLOWERS
CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

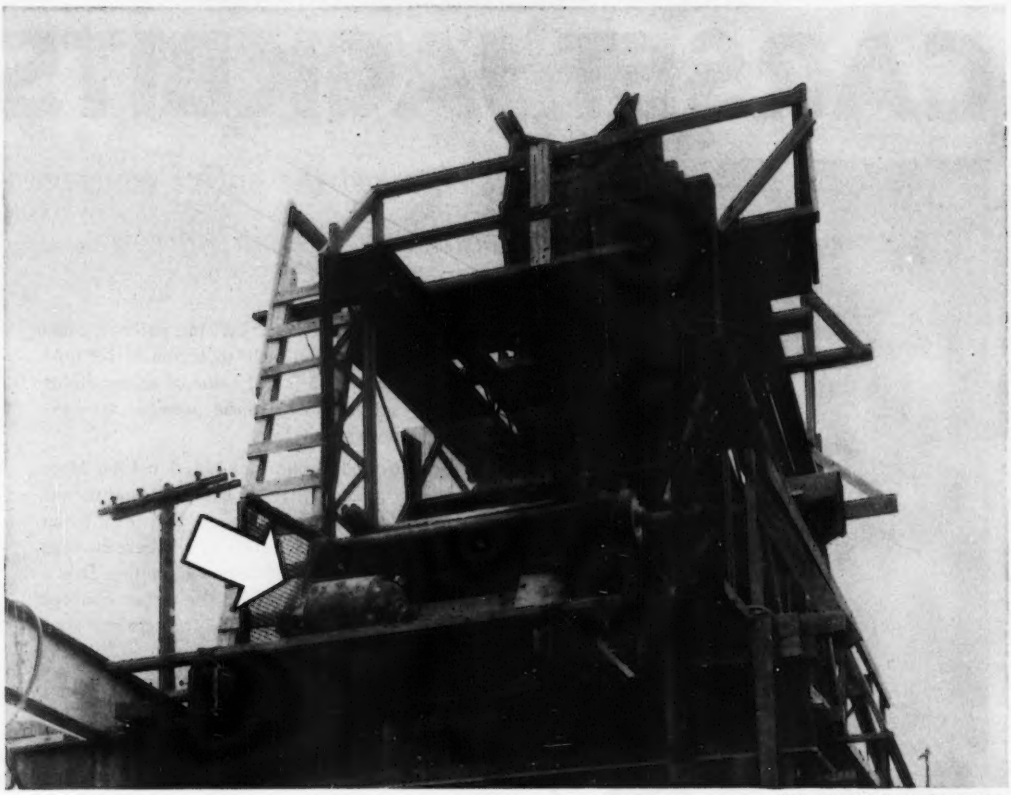

Photo courtesy M. A. Gammino Construction Co

Where grommet V belts are outlasting others 6 to 1

B. F. Goodrich grommet V belts cut costs 20 to 50%

THOSE three V belts run a rock screen that shakes down 1000 tons of rock a day. Ordinary V belts failed in one month because the drive whips and vibrates with such terrific force that the belts came apart at the sides.

B. F. Goodrich grommet V belts were installed six months ago, show no signs of giving any trouble. Here's where that extra strength comes from:

No cord ends—A grommet is endless, made by winding heavy cord on itself to form an endless loop. It has no overlapping ends. Because most of the failures in ordinary V belts occur in the region where cords overlap, the endless cord section in a grommet V belt eliminates such failures.

Concentrated cord strength—All of the cord material in a B. F. Goodrich grommet multiple-V belt is *concentrated* in twin grommets, positioned close to the driving faces of the pulley. No layers of cords to rub against one another and generate heat; cord and adhesion failures are reduced.

Better grip, less slip—Because a grommet is endless, a grommet V belt is more flexible, grips the pulleys better. Size for size, grommet multiple-V belts will give ⅓ more gripping power, pull heavier loads with a higher safety factor.

Only B. F. Goodrich has the grommet!—No other multiple-V belt is a grommet V belt (U. S. Patent No. 2,233,294). Now available in C, D and E sections. See your local B. F. Goodrich distributor. Ask him to show you his "X-ray" belt that illustrates grommet construction clearly. *The B. F. Goodrich Company, Industrial and General Products Division, Akron, Ohio.*

Grommet V Belts BY

B.F.Goodrich

RUBBER FOR INDUSTRY

ENGINEERING AND MINING JOURNAL

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DREDGING FOR MAINTENANCE

Get 'em by lubricating wire rope and open gears with TEXACO CRATER

Wire rope *stays strong longer,* and costs less to maintain, when lubricated with *Texaco Crater.* First, because this famous lubricant penetrates quickly *into* the rope . . . protecting the core as it lubricates the individual strands. Second, because *Texaco Crater* sets up a l-o-n-g-lasting, tough, elastic film that gives genuine protection against wear and rust even under severe conditions of flexing and friction.

To reduce maintenance costs for open gears . . . prolong their life and assure quieter operation . . . brush or spray them with *Texaco Crater X Fluid.* This is the easy-to-apply lubricant that *goes* on as a liquid without heating and *stays* on as a tough, wear-resistant coating that gives longer-lasting protection.

More copper mining equipment in the U. S. is lubricated with TEXACO than with any other brand

Another Maintenance Cost Reducer

In bearings of mine car wheels, use *Texaco Olympian Grease.* It stays in the bearings and assures easier starts and smoother operation winter as well as summer. Three consistencies to meet all requirements.

Let a Texaco Lubrication Engineer help you simplify your lubrication procedures and reduce maintenance costs on all your machinery. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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See newspaper for
time and station.

TEXACO

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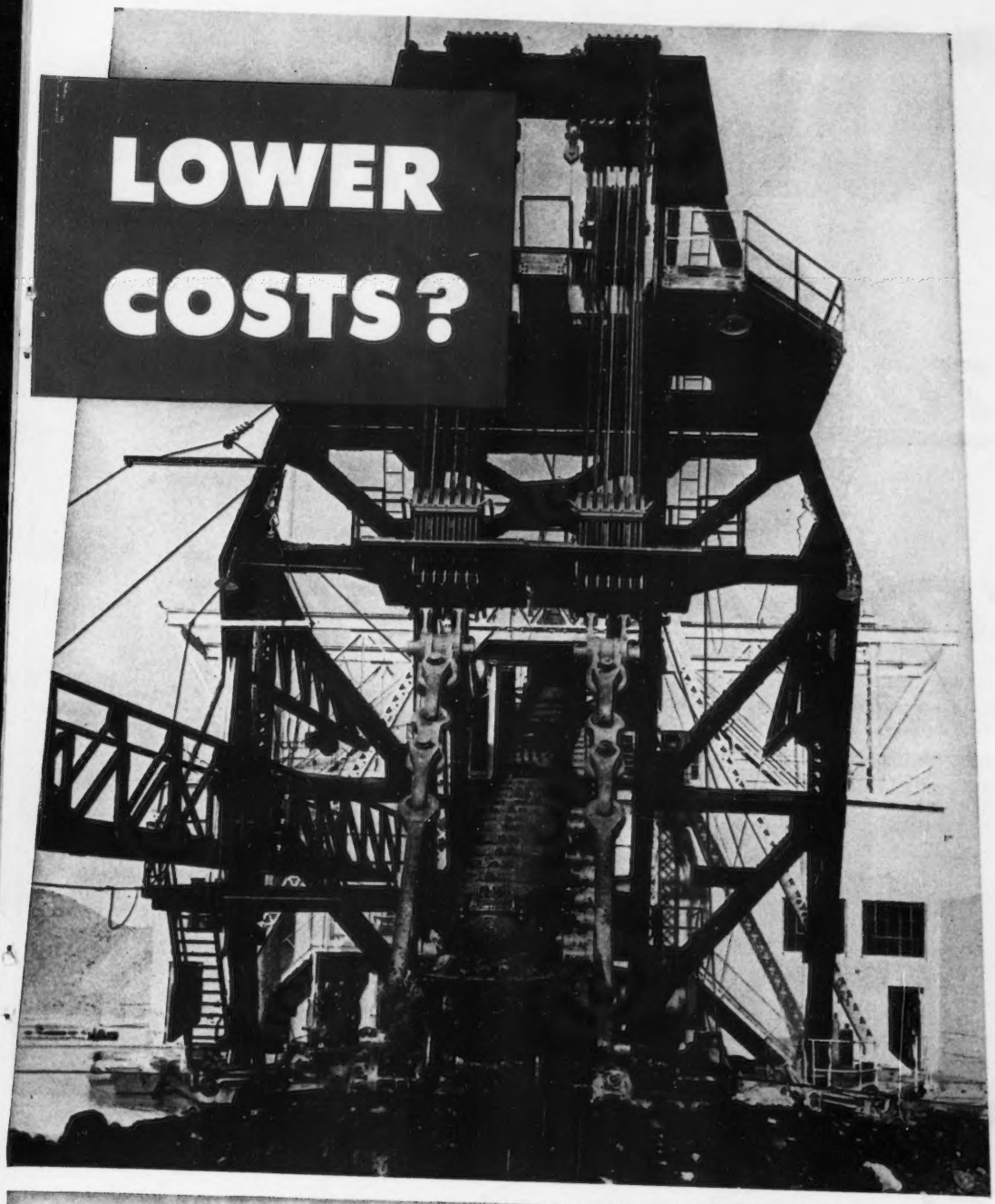
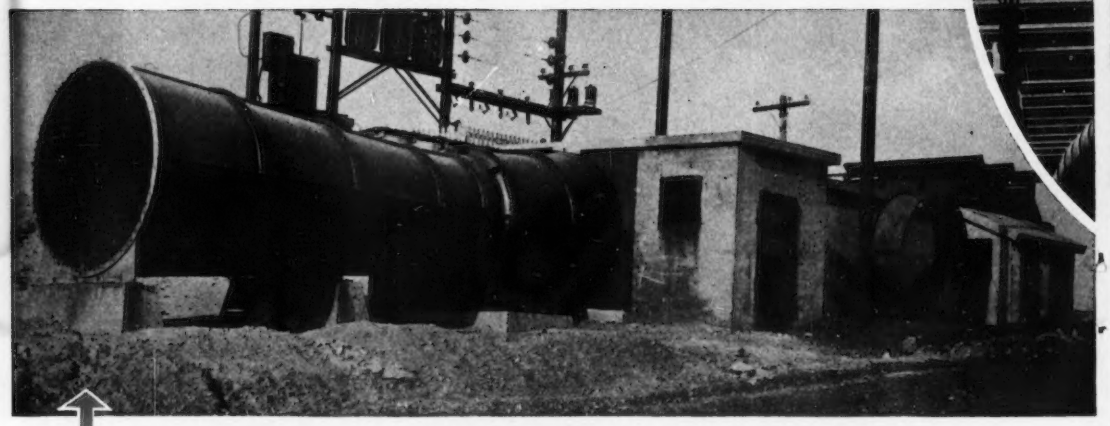


Lubricants and Fuels

FOR THE MINING INDUSTRY

JOY AXIVANE*

GIVE YOU TOP EFFICIENCY WITH ANY LENGTH OF TUBING



IF MAIN VENTILATION is your Problem

JOY AXIVANE* MINE FANS

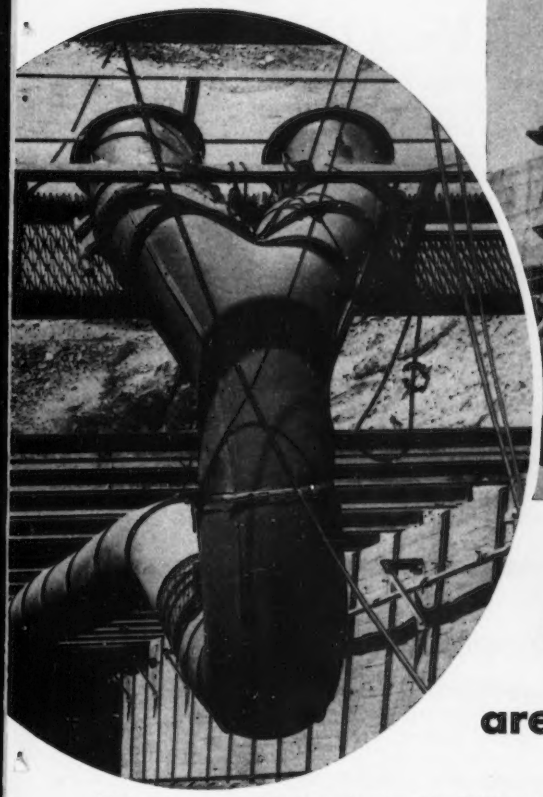
GIVE YOU MORE AIR AT FAR LOWER COST

*Trade Mark Reg. U.S. Pat. Off.

Right: a twin installation of Type I-21 JOY AXIVANE Blowers at a large metal mine.

BLOWERS

Below: the same twin units, looking down. Left, opposite page: a typical JOY AXIVANE Exhaust Mine Fan installation, at another metal mine.



JOY BLOWERS

are *All-Purpose* units

With the *vaneaxial* design, pioneered by JOY in mine ventilation equipment, you secure the great advantage of unmatched efficiency over the widest possible operating range. JOY AXIVANE Blowers give you top performance in either high or low pressure service. You don't need different types of blowers for different lengths of ventilation tubing, and you eliminate blower replacement when the tubing length must be changed. What's more, JOY Blowers are compact and space-saving, operate more quietly, provide smoother air flow and require minimum power. ● Let JOY solve your air supply problems . . . there are types and sizes of AXIVANE Blowers and Fans to meet every mine ventilation requirement.

Write for Bulletin, or *Consult a Joy Engineer*

W & D M 2348

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WHAT OTHER
GIVES YOU ALL THESE

1. High Strength per Pound of Metal Used

The *Superior* crusher has been designed by Allis-Chalmers to take advantage of the latest engineering practices, modern materials and manufacturing methods. Cast steel instead of cast iron construction makes the entire crusher highly resistant to shock. Integrally cast reinforcing rings on top and bottom shell provide high strength with an economical use of metal.

Cast steel spider arms are of box construction . . . offer greatest strength and least interference for feed. Spider is fully protected by rim and arm liners. Mainshaft is annealed forged steel. Concaves are manganese steel. The eccentric has a replaceable bronze inner sleeve and bottom shell bushing. Bevel gear and pinion are heat treated steel with spiral cut teeth.

2. High Capacity per Pound of Metal Used

As high as 3040 tons of stone or ore per hour can be crushed in the 60-89 *Superior* crusher (60-in. receiving opening). High capacity design includes: straight down discharge, eliminating need for diaphragm . . . a countershaft that runs at available motor speeds . . . a deep crushing chamber that is the result of over a half century of experience in building gyratory crushers.

The shape of this scientifically designed curved crushing chamber offers a broad area of breaking contact, which spreads wear over more surface. The crusher setting can be maintained over long periods. Changing the lower tier of concaves makes it possible to get various initial settings without changing the angle of nip — a big advantage.

3. Vertical Adjustment to Compensate for Wear

To compensate for wear on mantle and concaves, the *Superior* crusher has been designed so that the mainshaft can be raised with respect to the concaves. This is made possible by a long threaded portion of the mainshaft and a cast steel adjusting nut supported in the spider hub. The curved crushing chamber, moreover, has been designed to utilize this vertical adjustment to the fullest extent in compensating for wear.

The original discharge setting can be maintained, for all practical purposes, throughout the life of a single set of crushing surfaces with no more than one resetting of the concaves.

A-3316

Improved Lubrication System, Dust Seal

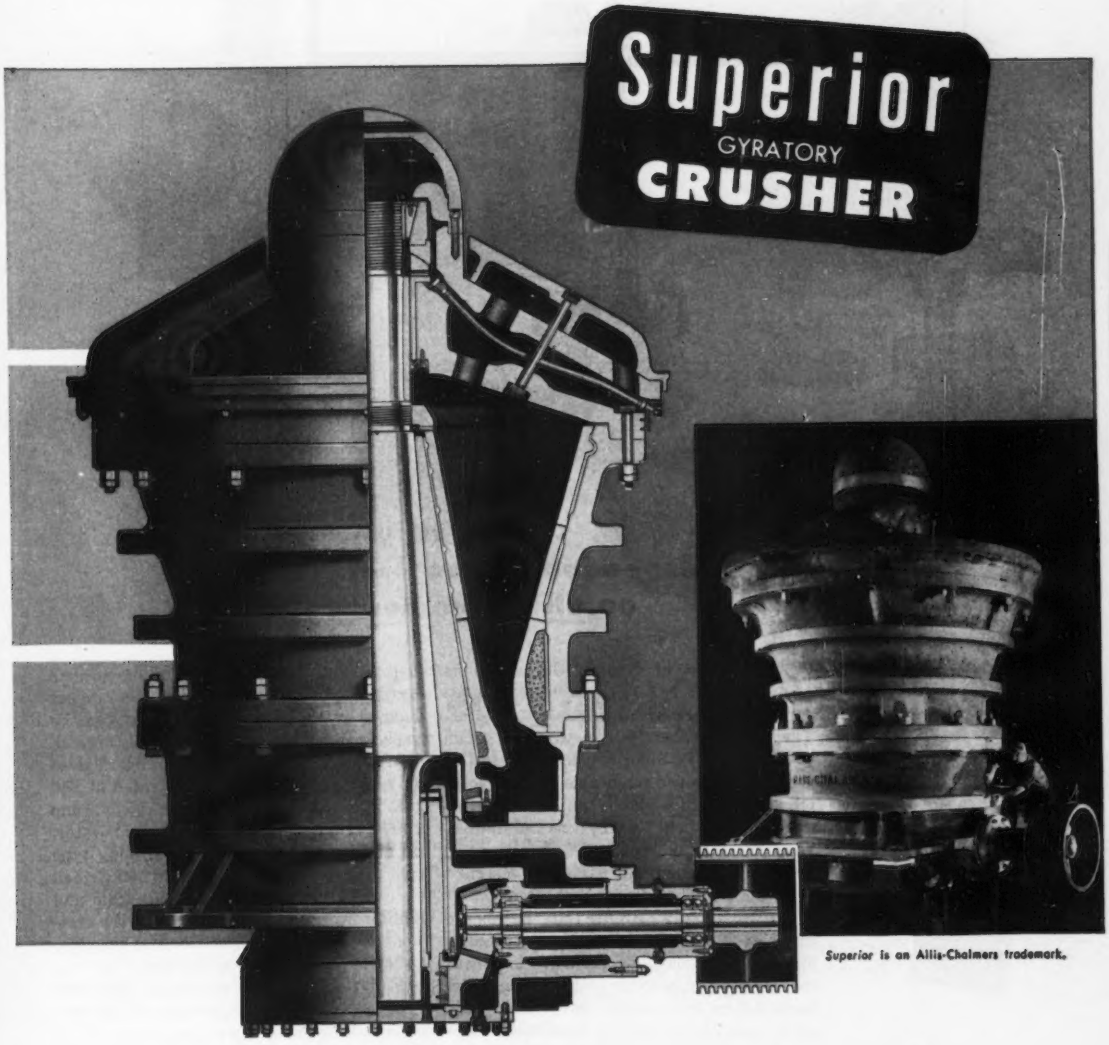
A fully automatic lubricating system consists of a tank, oil pump, motor, pressure type oil filter and condenser type cooler, all external to the crusher for better accessibility. Oil from tank is pumped through filter and cooler to the crusher, lubricating the eccentric wearing plate, then the inner eccentric bearing. It returns down the outer eccentric bearing, lubricates gear and pinion and returns to tank. Oiling system has protective flow and temperature switches.

An improved dust seal consists of a moulded fabric ring enclosed in a steel housing accommodating the vertical adjustment of the crushing cone as well as the gyrating and turning of the head.

More facts about the *Superior* crusher can be obtained from the A-C representative in your area. Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-

Primary Crusher
IMPORTANT ADVANTAGES?



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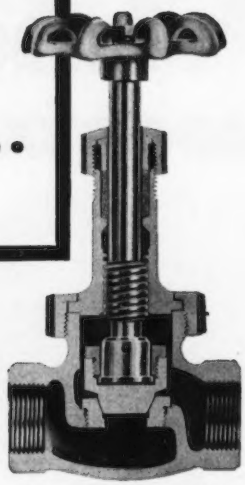
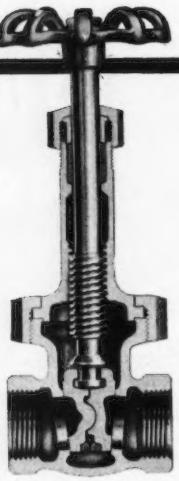
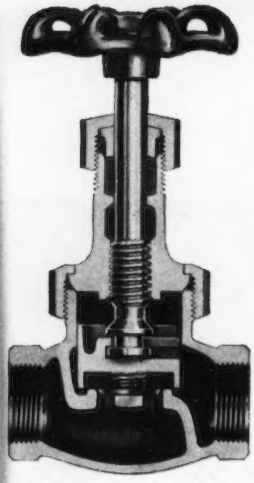
Walworth bronze valves...



Walworth No. 225P Globe Valve
500 Brinell Seat and Disc



Walworth
No. 29 Gate Valve



Walworth No. 95 Globe Valve
Re-New-Disc

built to give dependable trouble-free service on all recommended jobs

Walworth No. 95 Bronze Globe Valves (Angle Type: No. 96) are recommended for service where throttling is not required. They are rated at 150 psi working steam pressure, 500F; 300 psi cold water, oil or gas. The improved renewable disc and lock-on, slip-off disc holder — an original Walworth development—saves time and trouble. This valve can be repacked under pressure when fully opened. All parts are designed to give maximum service and strength.

Walworth No. 29 Bronze Gate Valves are rated at 200 psi working steam pressure, 550F; 400 psi cold water, oil and gas. These valves have rising stems and integral seats. Sizes 2-inch and smaller have union bonnets; sizes 2½ and 3-inch have bolted bonnets. Valves up to and including ¾-inch have solid wedge discs; 1-inch and larger have split wedge discs. These valves can be repacked under pressure when fully opened.

Walworth No. 225P Bronze Globe Valves (Angle Type: No. 227P) are rated at 350 psi working steam pressure, 550F; and 1000 psi non-shock service on cold water, oil and gas. The stainless steel, plug type seat and disc — heat treated to 500 Brinell — can be closed on sand, slag, scale and similar floatage, without injury to the seating surfaces. They are the longest wearing, TOUGHEST bronze valves you can buy.

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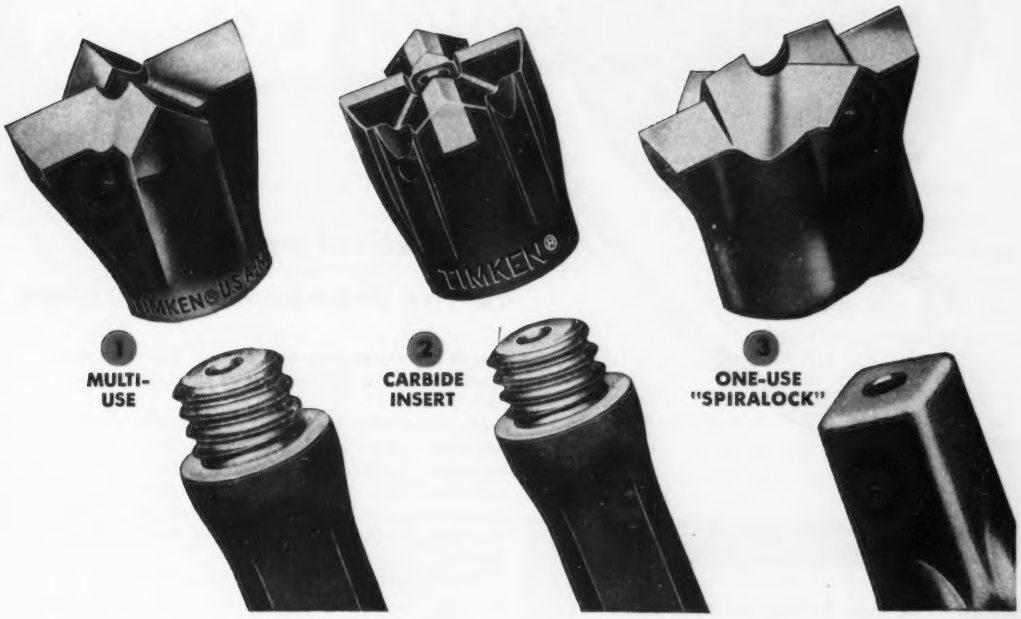

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This lightweight Gardner-Denver combination is specially designed for fast drilling with tungsten-carbide tipped rods and detachable bits. It consists of the new 45-pound S48 Sinker—the equal of most 55-pound drills in speed and power—mounted on the lightweight, long-travel FL2 Air Feed Leg.

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for more footage per man-hour
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from the drill doctor

Drills lubricated by the L012 Automatic Line Oiler *can't* run dry—never show symptoms of inadequate lubrication.

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This is one of several Northwests the Zonolite Corporation has put in service—repeat orders that prove Northwest ability in mine service where sustained output is paramount. The Northwest is a hard rock shovel. It is built for the hard jobs and if you have a real Rock Shovel *any* digging is easy.

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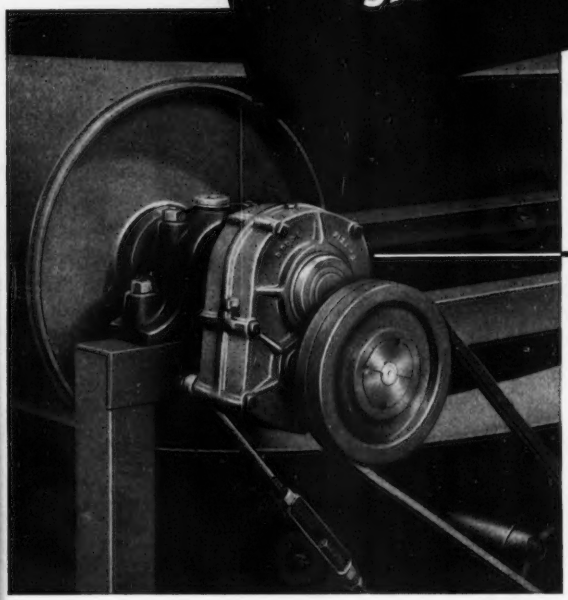

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model **HD-5**
40.26 drawbar hp.
11,250 lb.

Get the full story from your Allis-Chalmers dealer.
See these tractors perform. They're built for YOUR job!

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

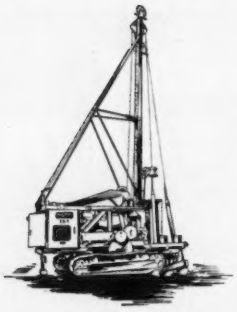
Originator of the Torque Converter Tractor

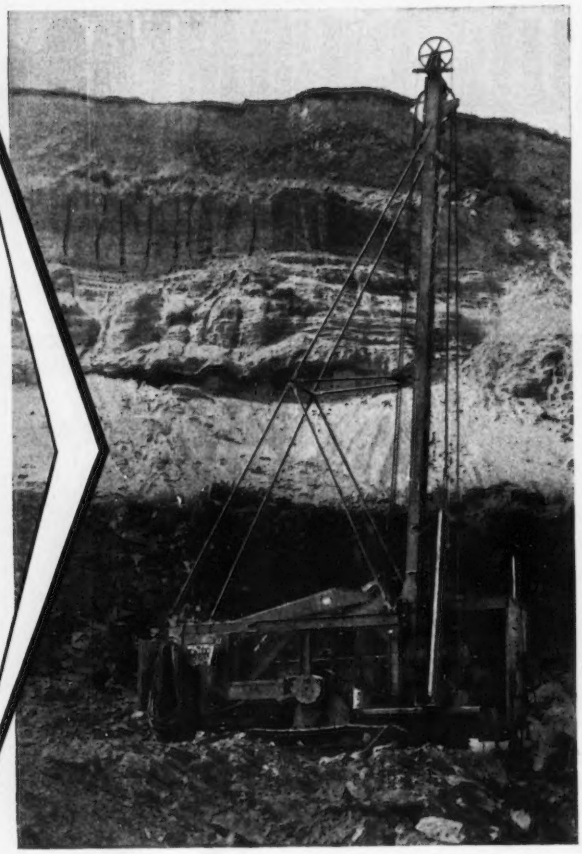
RAMROD PUNCH WITH A SHATTERING SNAP

That's

BUCYRUS ERIE

DRILLING ACTION





NOTED for fast penetration, hard-hitting Bucyrus-Erie Blast Hole Drills ram down 5⅜-in. to 12-in. diameter holes in short order — save hours of blast preparation time. High speed penetration is the result of two main factors:

1. BALANCED DRILLING MOTION

Bucyrus-Erie Blast Hole Drills are scientifically designed to provide the most effective combination of tool weight, blows per minute and length of stroke. The result is a balanced motion that produces outstanding hole footage even in the toughest drilling.

2. SHATTERING SNAP-BACK

Key to the super-shattering action of every blow is the snap-back of the bit provided by a rubber shock absorber — a Bucyrus-Erie first, and the most successful drilling rig shock-absorber yet devised. As the tools travel down, the discs compress. The instant the bit strikes, the discs expand and snap the tools away from the hole bottom, thus giving a sharp, smashing blow instead of a "dead" hit.

But fast hole penetration is only part of Bucyrus-Erie's low-cost drilling story. Let us send you all the details.

22-T	5⅝″	to	6⅝″	holes
27-T	6″	to	6⅝″	holes
29-T	6⅝″	to	9″	holes
42-T	9″	to	12″	holes

BUCYRUS ERIE

40851

SOUTH MILWAUKEE, WISCONSIN

"Washington calling!"

We were expecting this call. In a sense it is the people of America on the other end of the telephone. For some time they have been calling upon our government to take whatever steps are necessary to equip our fighting men for any job they may have to do.

Korea has proved the fallacy of limited preparedness. You know now that the nation is girding for survival. The people of America have said—and rightly—that private industry should provide the Armed Forces with whatever is necessary.

Machines are being mobilized. "Caterpillar" products are wearing olive drab once more. Because of large military demands your present machines may have to work longer than you had anticipated.

You can get many extra hours of machine service life if you:

1. Follow a sound program of operation and maintenance.
2. Consult your Operator's Instruction Book, using it as a constant guide in caring for your machines.
3. Secure the assistance of your "Caterpillar" dealer who now, more than ever before, is your working partner for the grim job that may lie ahead.

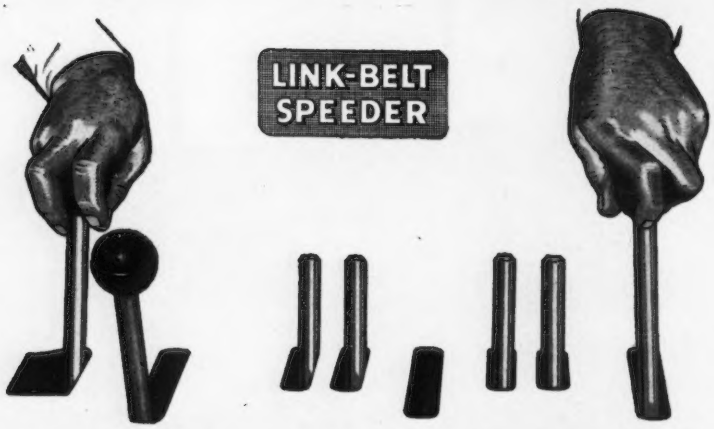
• • •

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

CATERPILLAR

REG. U. S. PAT. OFF.

Diesel Engines • Tractors • Motor Graders • Earthmoving Equipment



At your fingertips . . . up to 25% increased output with

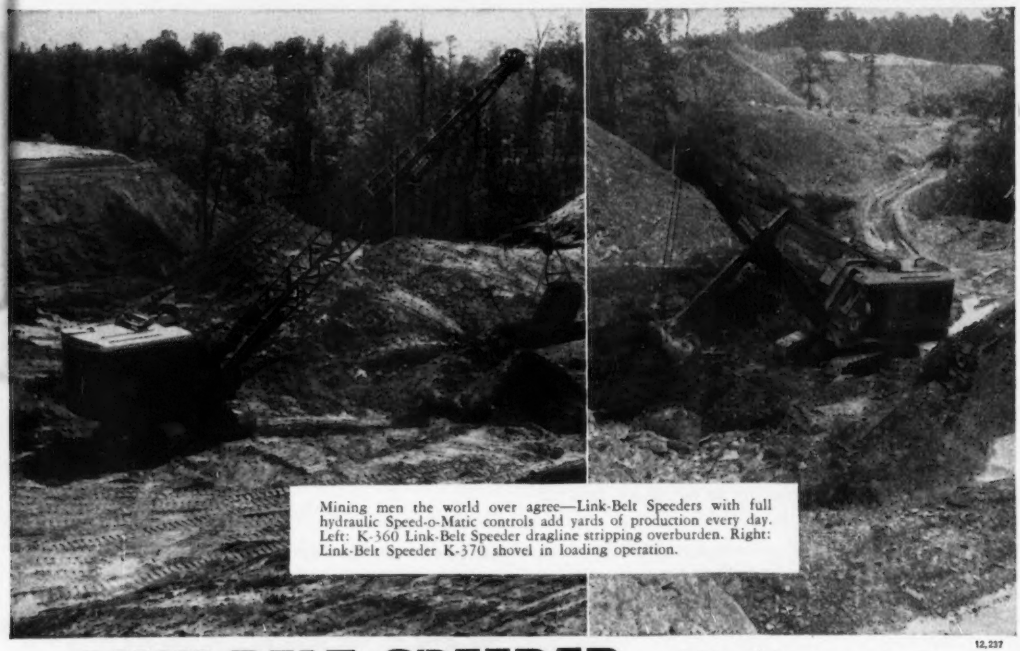
SMOOTHER, EFFORTLESS, *Speed-o-Matic* CONTROLS

Fingers instead of muscles do the work with Link-Belt Speeder's exclusive Speed-o-Matic* controls! Every move of Shovel-Crane is faster, more accurate, easier. You get "pin point" placement of bucket, shovel or hoe. No drag or lag, no jerk or jump. You "feel the load" every inch of the way—smoothly, surely, safely.

As for your operator, what a difference this control makes! He's fresh and fit, even during long overtime. And he lifts, loads and swings with a tireless precision that pays off in greater output, more profits for you.

Only Link-Belt Speeders offer you the unequalled advantages of Speed-o-Matic *full* hydraulic controls. Before buying any Shovel-Crane, be sure to see a demonstration.

*Available on 51, 300 and 500 Series.



Mining men the world over agree—Link-Belt Speeders with full hydraulic Speed-o-Matic controls add yards of production every day. Left: K-360 Link-Belt Speeder dragline stripping overburden. Right: Link-Belt Speeder K-370 shovel in loading operation.

12,237

LINK-BELT SPEEDER
CORPORATION

Builders of the most complete line of shovels, cranes and draglines
CEDAR RAPIDS, IOWA

TRIPLE SERVICE

Phosphate Flexible Hose Designed by G.T.M.
Handles 3 Times the Tonnage in Mining Mineral

GOODYEAR INDUSTRIAL RUBBER PRODUCTS
GTM-Specified PHOSPHATE
FLEXIBLE HOSE
A
B
C
A—Long-life, abrasion- and sun-resisting cover.
B—Reinforced with wrapped plies of heavy fabric plus wire helices to resist kinking.
C—Tube resists abrasion of sand, rocks, mud. Gauge depends on materials handled, angle of bend and size of sleeve.

ORDINARY-TYPE hose lasted 6 months—pumped 2,160,000 cubic yards.

Improved type, designed by the G.T.M.—Goodyear Technical Man—served 18 months—handled 6,480,000 cubic yards of clay matrix.

Whatever type of pumping, dredging or jetting work you do, you'll find it pays to consult the G.T.M. for his recommendations on hose—pays you in longer hose life, more dependable service, and is the lowest cost in the long run. Get in touch with the G.T.M. through your nearest Goodyear Distributor, or by writing Goodyear, Akron 16, Ohio.

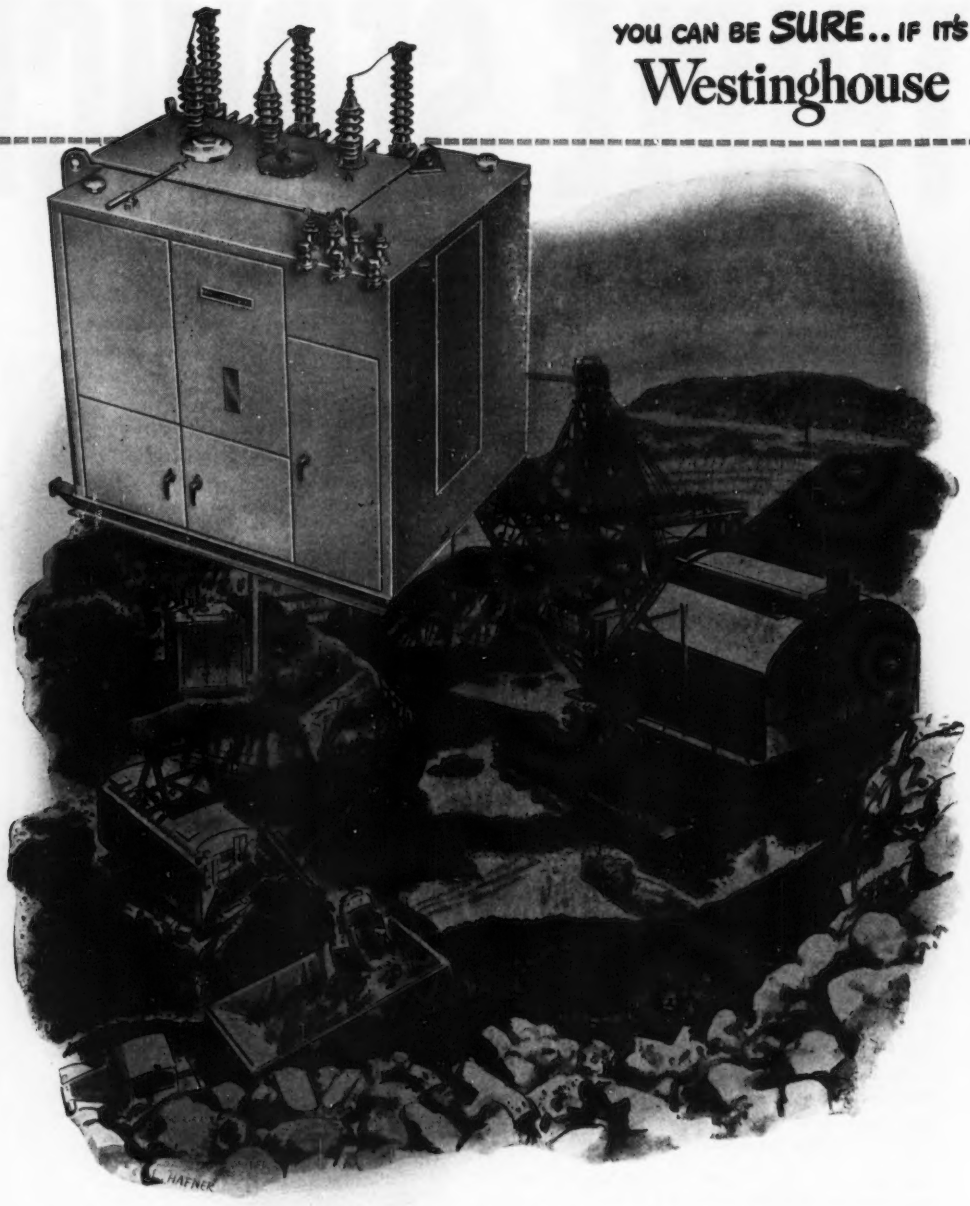
FOR HOSE, FLAT BELTS, V-BELTS, MOLDED GOODS, PACKING, TANK LINING, RUBBER-COVERED ROLLS *built to the world's highest standard of quality, phone your nearest Goodyear Industrial Rubber Products Distributor.*

GOODYEAR

THE GREATEST NAME IN RUBBER

We think you'll like "THE GREATEST STORY EVER TOLD"—Every Sunday—ABC Network

YOU CAN BE SURE.. IF IT'S
Westinghouse



"CSP"® POWER TRANSFORMERS

Save

Installation...Maintenance...Load-Change COSTS

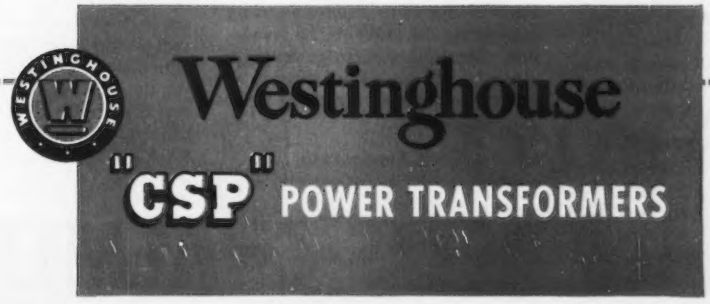
The quickest, easiest and most economical way to save on power costs is to install a Westinghouse "CSP" Power Transformer. Here's a *complete single-feeder substation* that saves you dollars right from the start.

Quick Installation. The "CSP" Power Transformer can be installed on either a concrete or a wooden stringer foundation. Just place the transformer on the foundation, tie in transmission and feeder lines and a complete single-feeder substation is ready for operation.

Simplified Maintenance. Here's a neatly designed and compact power transformer that enables all maintenance to be done from the ground level. The instrument and control panel is readily accessible and easy to read. It's completely enclosed to give absolute protection for year-round weather conditions.

Easy to Move. If load center changes, the integral substation may be easily . . . inexpensively . . . and completely moved. If loads grow, additional units can be easily tied in on the line.

In all "CSP" (Completely Self-Protecting) Power Transformers you get complete lightning, surge and fault protection . . . plus automatic voltage regulation, load switching and metering. In one package you have the best, most dependable single-feeder substation built today. For further information contact your nearest Westinghouse dealer or write for Booklet B-4692, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70578



HOW'S THIS FOR Accessibility?

ONE MAN can perform all routine maintenance jobs on this brand new line of Allis-Chalmers large motors. He can remove the upper halves of the end brackets and air baffles and reach right inside the motor with his vacuum cleaner or air hose. There is plenty of room to reach up back of the stator core through air discharge openings in the stator yoke.

Bearings Protected

The capsule-type sleeve bearings need not be opened up and exposed when the end bracket halves are removed. The bearings are protected from abrasive dust and dirt while the motor is being cleaned. This eliminates the work usually required to dismantle the bearing, clean and reassemble it during routine maintenance.

Easy Installation

Large stator air discharge openings with removable louvers allow ample room to use an electric or air drill for doweling and bolting the motor to the foundation. These large discharge openings plus adequate air intake openings in the end bells provide cooling air at low velocities.

Sleek Appearance

You'll be proud of the appearance of the new Allis-Chalmers motor in your plant, too. Clean, simple lines and smooth contours give outward confirmation of its inner strength.

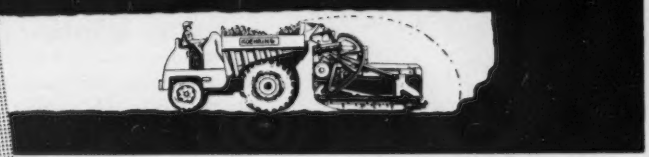
These new design Allis-Chalmers drip-proof and splash-proof bracket bearing squirrel-cage induction motors are built in sizes from 60 hp at 300 rpm to 1500 hp at 1800 rpm. Ask your Allis-Chalmers representative to show you the details of this exceptional new motor or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin 05B7542. A-3251

ALLIS-CHALMERS

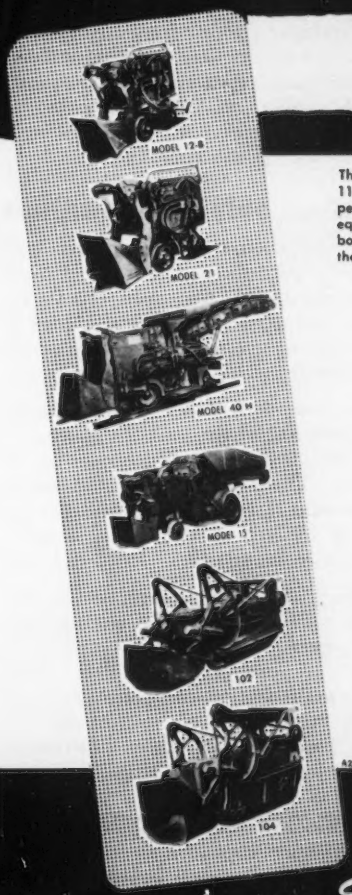
CASE HISTORY OF A SUCCESSFUL TUNNEL JOB

FROM THE EIMCO FILE T270

KEYHOLE DAM TUNNEL



The Keyhole Dam outlet tunnel near Moorcraft, Wyoming 654' in length. Approximately 11'x12' arched cross section. Tunnel driven in 35 shifts. Average round 8.06 ft. 2.33 rounds per shift. 33.15 — 9' holes per round. Average 2.66 lbs. powder per cubic yard. Loading equipment—Eimco 102 RockerShovel. One interesting fact about this tunnel is the use of roof bolting instead of steel or wood sets. Using 4.40 ft. of Roof Bolts for each foot of tunnel the contractor was able to make exceptionally good time. Haulage units used were Dumptors.



Eimco RockerShovels are well known in mining circles all over the globe. The Eimco is the first successful underground loading machine of its type and today thousands of these hard rock loading machines are at work loading about 80% of all rock loaded underground.

Six separate and distinct models cover the complete range of tunnel sizes from small 5'6" sewer tunnels to large hydro-electric and railroad size tunnels.

Eimco equipment is engineered for the job. Let us tell you how an Eimco can save you money as it does thousands of users every day.

Write for bulletin L-1024 on "How an Eimco Can Save You Money."

A286

You can't beat an Eimco!

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES: SALT LAKE CITY 10, UTAH, U. S. A.

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KELLOGG, IDAHO, 307 DIVISION STREET

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IN ENGLAND: EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND
AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

J. Robert Bazley boosts with

Big 12'5" x 8' top opening speeds shovel swings, reduces spillage. Bazley's 4-yd. stripping shovel heaps 15 bank yards of sand and clay into Tournarocker body in 2½ to 5 minutes, depending on bank conditions.

Stripping 3,000,000 cubic yards of sand, clay and rock from anthracite coal deposits at Mt. Carmel, Pennsylvania, J. Robert Bazley, Inc. of Pottsville has been using 3 rear-dump C Tournarockers for nearly a year to haul from a 4-yard stripping shovel.

Complete 4200′ cycle in 7.4 minutes

Tournarockers are loaded in an average of 3 to 4 passes from the well-heaped dipper . . . carry 15 bank yards per trip. Checked on a typical 4200′ cycle, each 16-ton rig averaged a round trip every 7.4 minutes . . . including 3.6 min. to load, 0.3 min. to dump, and 3.5 min. for haul and return. Conventional dump trucks of smaller capacity, loaded by the same shovel and traveling over the same haul road, averaged 7.9 minutes for the same cycle.

In 5 months . . . only 7% downtime

In 2,000 hours of operation, the Tournarockers have maintained a 93% job efficiency record. "We're particularly impressed with the clean dump, the safety when the rear wheels are over the edge of the dump, and the extreme maneuverability of the units," says J. Robert Bazley, Company President.

In addition to these 3 LeTourneau rear-dumps, Bazley also is working 2 of the same C Tournapull prime movers with 16-ton Carryall Scrapers at the Mt. Carmel mine. These 186 h.p., electric-control prime movers are also interchangeable with flat-bed and bottom-dump haulers, as well as on scrapers, rear-dumps and other equipment.

Check the economy of these modern, 35 m.p.h., rubber-tired rigs for yourself before starting any major stripping operation. With these up-to-date LeTourneau units in your production fleet, you'll find that you can get lowest-net-cost-per-yard in any type of material, in any kind of weather, and on any sort of job. See your LeTourneau Distributor for complete facts and figures, or write TODAY.

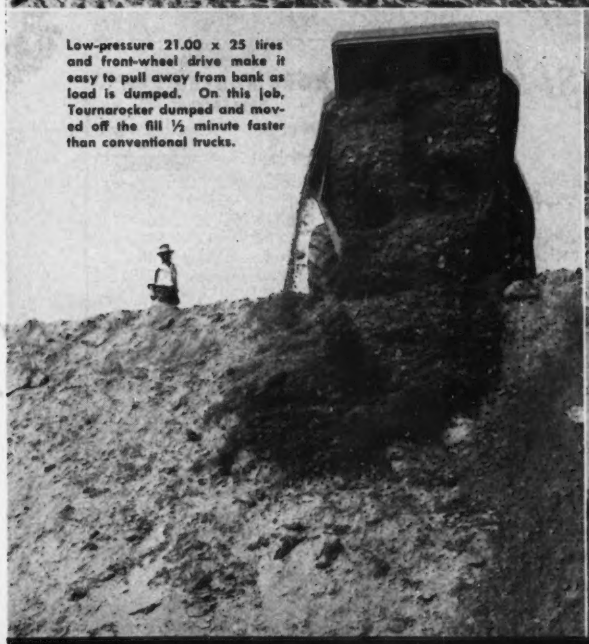
Mail today to: **R. G. LeTOURNEAU, INC., Peoria, Ill.** for more information on 35 m.p.h.

NAME..... TITLE.....
COMPANY.....
STREET.....
CITY..... STATE.....
Type of work handled.....

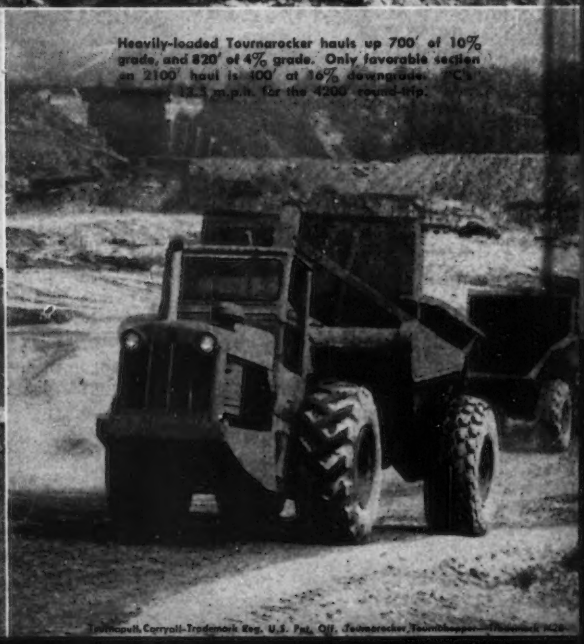
C Tournapull for use with:

- ☐ 17 cu. yd., rear-dump Tournarocker
- ☐ 13.5 cu. yd. Carryall Scraper
- ☐ 15 cu. yd., bottom-dump Tournahopper

strip production
3 "C" TOURNAROCKERS



Low-pressure 21.00 x 25 tires and front-wheel drive make it easy to pull away from bank as load is dumped. On this job, Tournarocker dumped and moved off the fill ½ minute faster than conventional trucks.



Heavily-loaded Tournarocker hauls up 700' of 10% grade, and 820' of 4% grade. Only favorable section on 2100' haul is 100' at 16% downgrade. "C's [illegible] 13.5 m.p.h. for the 4200' round-trip.

Tournapull, Carryall-Trademarks Reg. U.S. Pat. Off. Tournarocker, Tournahopper-Patents [illegible]

LETOURNEAU TOURNAROCKERS

PEORIA, ILLINOIS

HIGH SPEED on RUBBER PLUS TRACTION ADVANTAGES of a CRAWLER

ROCKMASTER *blast by Fauzio Brothers at Lehigh Navigation Coal Company's Nesquehoning, Pa., stripping operation.*

No rock pile this . . . but the high point of a blast!

THE machine-gun camera reels off twelve photos—one every 1/3 second—to "freeze" at its peak this typical ROCKMASTER "16" blast—three seconds after initiation of the shot. Here you see no wasted explosives gas, no wild rock—proof that ROCKMASTER "16" blasting can mean true *controlled force . . . controlled throw . . . controlled breakage!*

ROCKMASTER "16" may be the answer to *your* problems whether your job calls for blasting coal, rock, ore. The free ROCKMASTER "16" booklet shows how you can profit through the use of the correct numbers of the *sixteen* ROCKMASTER milli-second delay electric blasting caps teamed with the ROCKMASTER system of explosives choice and loading methods. Write for your copy. Our technicians will be glad to assist you in applying ROCKMASTER "16" to your operations.

ROCKMASTER "16" TIMINGS

Rockmaster No.	Avg. Time of Each Delay from Zero (milli-seconds)
0 (zero)	0 (inst.)
1	8
2	25
3	50
4	75
5	100
6	125
7	150
8	175
9	200
10	250
11	300
12	350
13	400
14	450
15	500
16	550

Rockmaster: Reg. U. S. Pat. Off.

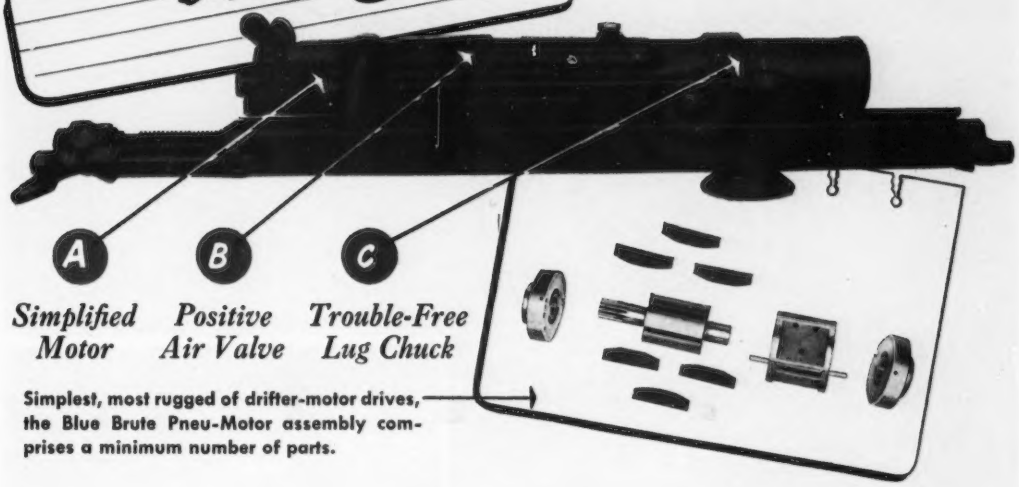
ATLAS EXPLOSIVES *"Everything for Blasting"*

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington, Del. • *Offices in principal cities* • *Cable Address—Atpowco*

The "A·B·C" of Faster, Lower Cost Drilling

Only **BLUE BRUTE** *Drifters Offer You This Performance-Boosting Construction at Three Key Points!*



Simplified Motor *Positive Air Valve* *Trouble-Free Lug Chuck*

Simplest, most rugged of drifter-motor drives, the Blue Brute Pneu-Motor assembly comprises a minimum number of parts.

Motor, valve and lug chuck—when these three drifter-elements pull together smoothly, you're on your way to yardage records! And in Blue Brute Drifters you can count on these key features for non-stop dependability on the toughest jobs you'll ever meet up with. Here's why:

(A) **Pneu-Motor** . . . Not "adapted" from some other air equipment, but especially designed for Blue Brutes, the Worthington Pneu-Motor is a standout for ruggedness—and the simplest drifter motor made. Parts are larger and fewer, assuring top wear-resistance and freedom from work-halting breakdowns.

(B) **Valve Assembly** . . . A famous Worthington "exclusive" that has won the tribute of being copied. But for checking wear and reducing air consumption, no other valve—copy or not—has ever equalled the positive-acting, end-seating Blue Brute valve.

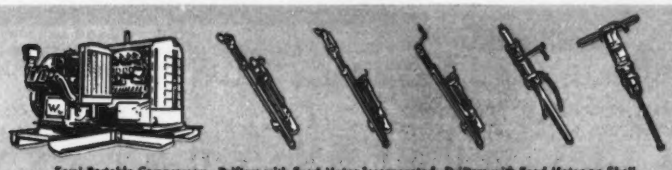
(C) **Lug Chuck** . . . In Blue Brute Drifters the one-piece chuck sleeve reduces friction, holds alignment better, allows the piston to hit cleaner and harder. Worth considering when you remember that the chuck area is a major trouble-spot in ordinary drifter design.

WORTHINGTON

WORTHINGTON PUMP AND MACHINERY CORPORATION

Mining Drill Sales Division • Dunellen, New Jersey

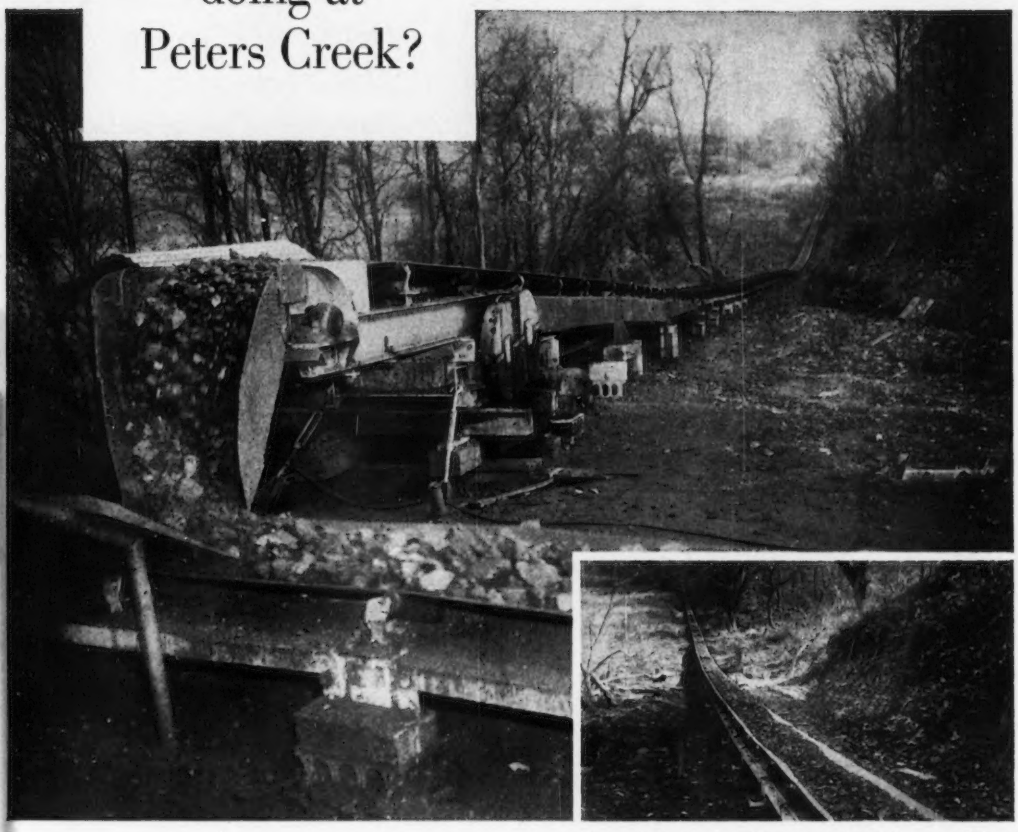
HD-8



Semi-Portable Compressors. Drifters with Feed Motor Incorporated. Drifters with Feed Motor on Shell. Hand-Crank Drifters. Stopers. Hand-Held Rock Drills.

Why not let your miners try Worthington Drifters—the WPM (Pneu-Motor on drifter), the WPMS (Pneu-Motor on shell) or the WHC (Hand Crank). Meanwhile, for further facts proving there's more worth in a Blue Brute, write for literature on the complete line.

What's U.S. Rubber doing at Peters Creek?



ITS BELTS are carrying 300 tons of crushed coal per hour. These belts, three in number, are known as U.S. Giant 4-ply Style XN Conveyor belts, of patented nylon construction. They connect the crusher to the tipple of Peters Creek coal mine. The belts replaced 10-ton trucks which always became mired in winter mud. This unusual conveyor installation provides a steady, dependable flow of coal over hills and through valleys, saving trucking and handling.

When you have a coal haulage problem, call in a U.S. Rubber engineer. He is a specialist in overcoming obstacles, lowering haulage costs.

Large photo shows coal being transferred from one belt of 3100' centers to belt of 1700' centers. Small photo shows section of the 3100'-center belt. Note the troughability and excellent training.

Here the 1700' center belt carries the coal along to the tipple. Note how it "contours" or hugs the terrain, taking the straightest possible course to its destination.

PRODUCT OF

U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Here's a Wire Rope That LASTS

J&L STEEL

Operators Get Longer Service Life with . . .

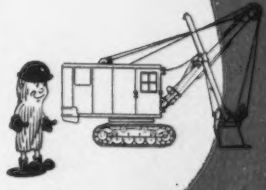
J&L CENTERFIT WIRE ROPE

If you're responsible for the wire rope on clamshells, shovels or any other earthmoving equipment that operates on small diameter sheaves and drums, J&L CenterFit Wire Rope can help you save money.

CenterFit, produced exclusively by Jones & Laughlin Steel Corporation, has a unique design engineered to give you more steel and fewer voids than conventional wire rope. All strands run in the same direction with outside strands fitting snugly into the valleys between inside strands. The result—greater strength . . . easier handling . . . which means longer service life.

In addition J&L CenterFit is lubricated with BRONZ-LUBE, the exclusive J&L lubricant with high film strength that prevents squeezing out between the strands. BRONZ-LUBE contains fine flakes of soft bearing metal that provide a smooth wear-resistant surface for every wire—forms a close adherent coating that doesn't drip off unless subjected to extremely high temperatures.

Users' records prove that J&L CenterFit lubricated with BRONZ-LUBE reduces operating costs, diminishes downtime and increases profits when used in the applications for which it was designed.



AND HERE'S HOW YOU CAN FIND OUT MORE ABOUT CENTERFIT WIRE ROPE!

Just write to Jones & Laughlin Steel Corporation, 412 Jones & Laughlin Building, Pittsburgh 30, Pa., and ask for a free copy of our booklet, "CenterFit." It gives you detailed information on the construction and applications of this exclusive J&L wire rope and tells how others are saving money through its use.

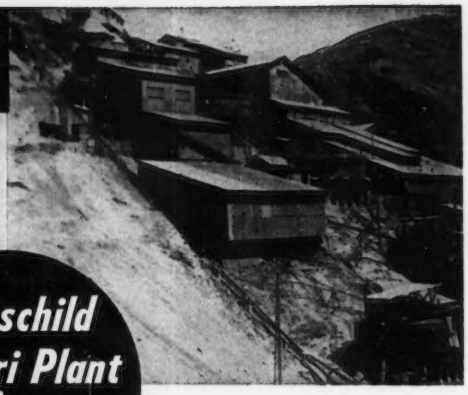
JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in OTISCOLOY *and* JALLOY *(hi-tensile steels).*

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

Recover Tin, Tungsten and other high Specific Gravity minerals in —200 mesh range at low cost with—

DENVER BUCKMAN ➡ Tilting Concentrator



Hochschild Colquiri Plant in Bolivia recovers 15 tons per month at a cost of only 7c per ton milled

(Quoted from November 1950 Mining Engineering)

"The tests reported in this paper indicated a tin recovery of 42 pct. The actual plant results for 1949 show a 54 pct. tin recovery from the Sullivan (Denver-Buckman) decks.

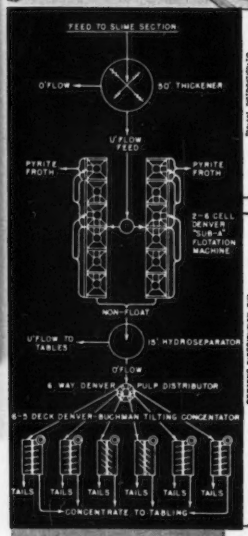
"The total average quantity of tin produced from the S deck section in 1949 was 15 tons of tin per month. This corresponds to 3 pct. of the total mill recovery.

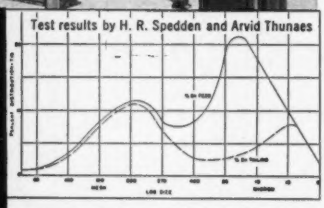
"The operation of the whole slime plant in Colquiri including flotation and fine sand tailing, cost $0.07 per ton milled.

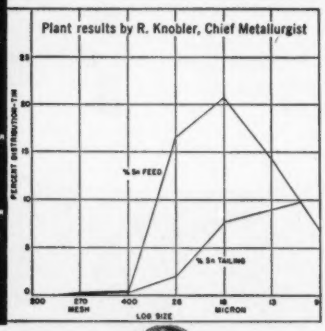
"In the year 1949 only $317.00 was spent for spare parts and material for the Sullivan decks in Colquiri with a total of 268,600 tons milled."

Because of its ease of operation, The Denver-Buckman Tilting Concentrator is far superior to any known type of machine for recovery of cassiterite and other high specific gravity materials in fine sizes.

Denver-Buckman Concentrators are available in half sizes for laboratory pilot plant work, or the testing can be done by Denver Equipment Company Ore Testing Division on a cost basis.







FLOTATION ENGINEERS

DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

WRITE TODAY FOR DETAILED INFORMATION

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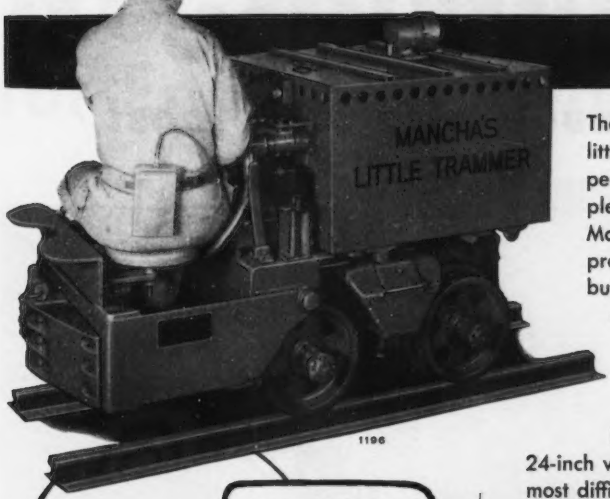
DENVER EQUIPMENT COMPANY, 1402 17th St., Denver 17, Colorado

MANCHA'S LITTLE TRAMMER

A Safe Ride



1196

The 200-pound motorman of this powerful little 1½ ton storage battery locomotive is perfectly safe—and he knows it. There's plenty of cab room for him to operate the Mancha with unhampered movements. To protect him from injury, the cab is stoutly built of rolled steel, with a sturdy bumper and safety guard.

Equipped with directional controller, lever brake, warning gong, and reversible headlight, Mancha's Little Trammer is safe to drive. On a 24-inch wheelbase, it holds the track under the most difficult of conditions. It's safe to ride.

Mancha builds 'em safe all right. Look at the lugs on that bracket. A car could never in the world climb that safety guard!

Yep! That safety guard and seat is a one-piece unit. When it's in place, the rider is comfortable and well protected. When it's removed, the cab can be raised to effect a short caging length.

1177

A Safe Buy

Mancha's Little Trammer is a mining man's locomotive, developed by mining men, for mining men—RIGHT IN THE MINES. Mancha's construction is simple and rugged, a fact that means low operating and maintenance costs. Its oversize motor gives it big haulage capacity, assuring an adequate supply of empties at the chutes and working faces, and a steady string of loads at the shaft or mill bin. Trouble-free service is assured by:

- STRONG, EFFICIENT WORM TRANSMISSION
- EXTRA LARGE AXLES
- ROLLER AND BALL BEARINGS THROUGHOUT
- CIRCUIT BREAKER
- UNBREAKABLE ALLOY GRIDS
- STURDY, WELL-SECURED BATTERY BOX

In short, Mancha's Little Trammer assures protection throughout—for the man who operates it; for the man who buys it.

Mail the coupon for illustrated bulletin showing performance charts and complete specifications.

Mancha Storage Battery Locomotive, U.S.A.
Division GOODMAN Manufacturing Company
4850 South Halsted Street, Chicago 9, Illinois
E&MJ—451

NAME _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

MANCHA STORAGE BATTERY LOCOMOTIVE

Division GOODMAN Manufacturing Company
4850 SOUTH HALSTED STREET CHICAGO 9, ILL., U. S. A.

How to pick the "Winner" for tough wire rope jobs!

SHOVEL ROPE—Tiger Brand 6 x 41 Lang Lay with Independent Wire Rope Core. Made only in Monitor grade. Has high abrasion and fatigue resistance. The wire core adds to its strength and prevents distortion. This Tiger Brand Rope has earned an enviable reputation where the digging is hardest.

• You can make money or lose it by the way you select wire rope. It's good to pick a rope like American Tiger Brand—that has proved its merits over a period of years—but that's only part of the story.

Some types of ropes are good in mud and sand—others are not. Some can stand bending fatigue caused by small sheaves, others break up under this abuse. The point is—can *you* tell by looking at a rope whether or not it will be a "winner" on your job?

Take a tip from the Tiger Brand Specialist

Here's a man who knows his ropes. He can tell you the construction that should be best for your particular needs. Don't hesitate to call him in. He has the experience to help you pick a winner . . . and the right rope for your job can cut your wire rope costs in half. Write for our handbook, "American Tiger Brand Wire Rope" which shows all the different constructions. Address American Steel & Wire Company, 842 Rockefeller Bldg., Cleveland 13, Ohio.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

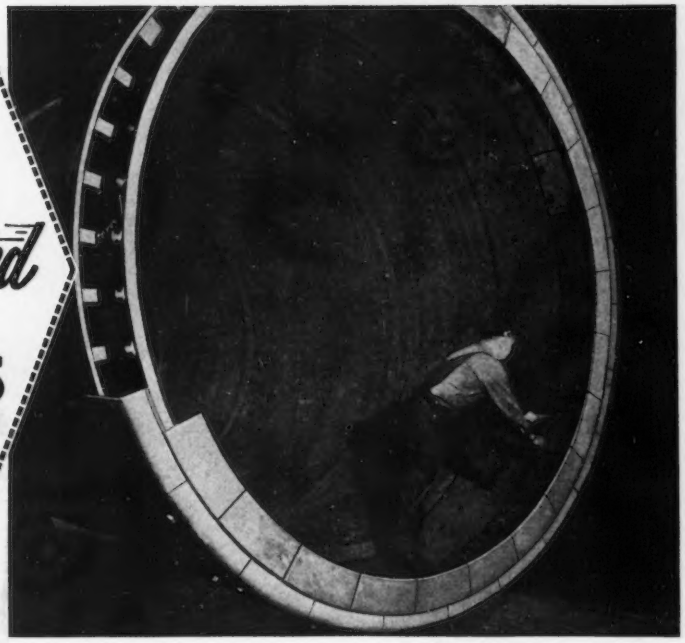
AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

UNITED STATES STEEL

NO SHUTDOWNS
for End Brick Replacement!

WITH THIS
ALLIS-CHALMERS
Air-Cooled End
FOR
ROTARY KILNS



GET RID of nose brick troubles for good with the Allis-Chalmers air-cooled kiln end shown above. The segmental alloy steel retaining ring forms a channel through which a blast of cooling air is forced.

Result: No kiln warpage; refractory brick lasts as long at discharge end as at any point along the kiln.

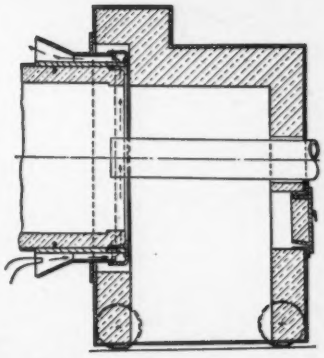
This one feature alone will, during the working life of the kiln, *pay for itself several times over* in reduced downtime and increased production . . . in lower refractory costs and longer kiln life.

Air-cooled kiln end design makes possible the use of a more positive air seal, resulting in fuel savings.

Other important features of Allis-Chalmers rotary kilns:

- Extra thick shell at discharge end and under riding rings.
- Centralized instrument control of the entire operation.
- Modern heat recuperation equipment. Constant delivery feeders and all auxiliary kiln equipment.

Get more facts from the A-C representative in your area, or write for Bulletin 07B6368, Allis-Chalmers, Milwaukee 1, Wisconsin. A-3281



Sketch shows arrangement of movable firing hood with air-cooled kiln end.

Texrope is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.

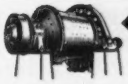
Motors

Controls

Texrope Drives

Vibrating Screens

Crushers


Grinding Mills

In the re-evaluation of projects hitherto deemed uneconomic...

Higher metal prices, sustained demand into the foreseeable future and advances in beneficiation practice encourage the development of ore-bodies previously considered sub-marginal. Critical re-examination of dormant development projects may now reveal worthwhile opportunities to permit profitable output of strategic minerals.

In your beneficiation studies and in implementing your decisions, Cyanamid Field Engineers and the Cyanamid Mineral Dressing Laboratory stand ready to render very constructive help.

Cyanamid Field Engineers have been working with mill metallurgists in practically every mining field for over 30 years. In that time, they have tackled thousands of treatment problems encompassing extremely varied combinations of minerals under all sorts of mill operating conditions. Through a world-wide technical intercommunication system flowing from the Cyanamid Mineral Dressing Laboratory, they have kept completely and continuously informed on new milling techniques, new reagent and process applications. Our composite experience as a clearing house for technical data usually enables us to make specific suggestions.

Recent discoveries may furnish the clue to economic operation of your development projects under present conditions. New Cyanamid Reagents added to or substituted for traditional reagents may provide the required recovery at permissible costs. The use of Heavy-Media Separation or the Dutch State Mines Cyclone Separator Processes may make the difference between profit and loss on lower-grade ores.

It is not one day too early to find out what Cyanamid can do to help. Starting point is a discussion of your problem with the Cyanamid Field Engineer in your district, so that he can bring to bear all the resources of the Cyanamid Mineral Dressing Laboratory on its successful solution. Your letter or telephone call will receive prompt and intelligent attention.

AME Cyanamid COMPANY

VISION

30 ROCKEFE YORK 20, NEW YORK

Printed in U.S.A.

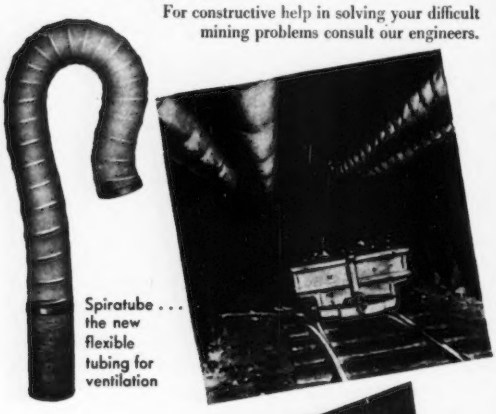
DIGGING FOR PROFITS?

They'll carry the load!

Here's mining equipment designed by men who have solved many difficult mining problems in many different parts of the world . . . mining equipment manufactured by a company with over 50 years' experience in serving the mining industry! Only a few examples of the many types of mine cars manufactured are shown here.

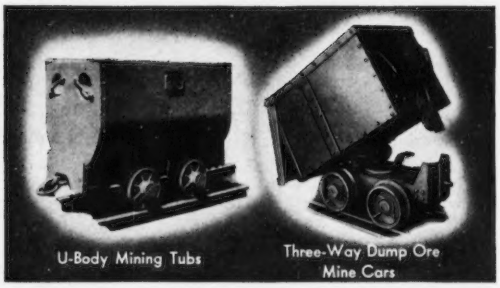
To mining engineers concerned with the increasing costs of mine operation, "Pressed Steel Car Company" equipment will give dependable, efficient, trouble free service.

For constructive help in solving your difficult mining problems consult our engineers.



Spiratube . . . the new flexible tubing for ventilation

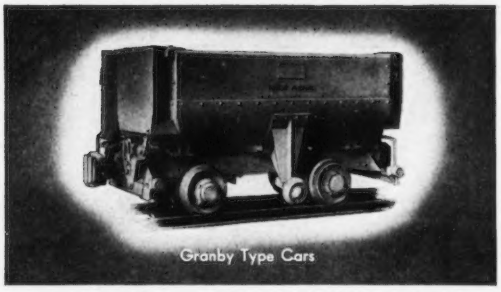
Mining Locomotives



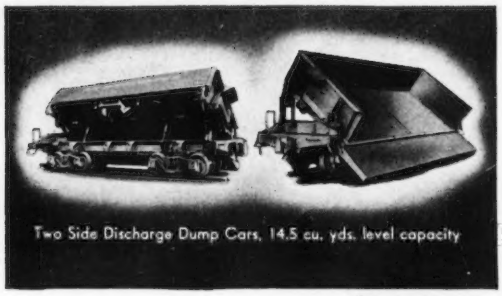
U-Body Mining Tubs

Three-Way Dump Ore Mine Cars

Track work and car parts



Granby Type Cars



Two Side Discharge Dump Cars, 14.5 cu. yds. level capacity

Other Products...

WEST VIRGINIA STEEL and MANUFACTURING CO.
Steel rails, steel crossties, track accessories, switches, crossings, frogs, etc.

THE FATE-ROOT-HEATH COMPANY
Brick manufacturing machinery.

PLYMOUTH LOCOMOTIVE WORKS
Internal combustion motor locomotives from 3 to 70 tons (alcohol, gasoline, Diesel and Diesel-electric).

WOOLERY MACHINE COMPANY
Weed burners, gang cars, rail motor cars.

FLEXIBLE TUBING CORPORATION
Flexible Tubing.

PSC

Steelcar

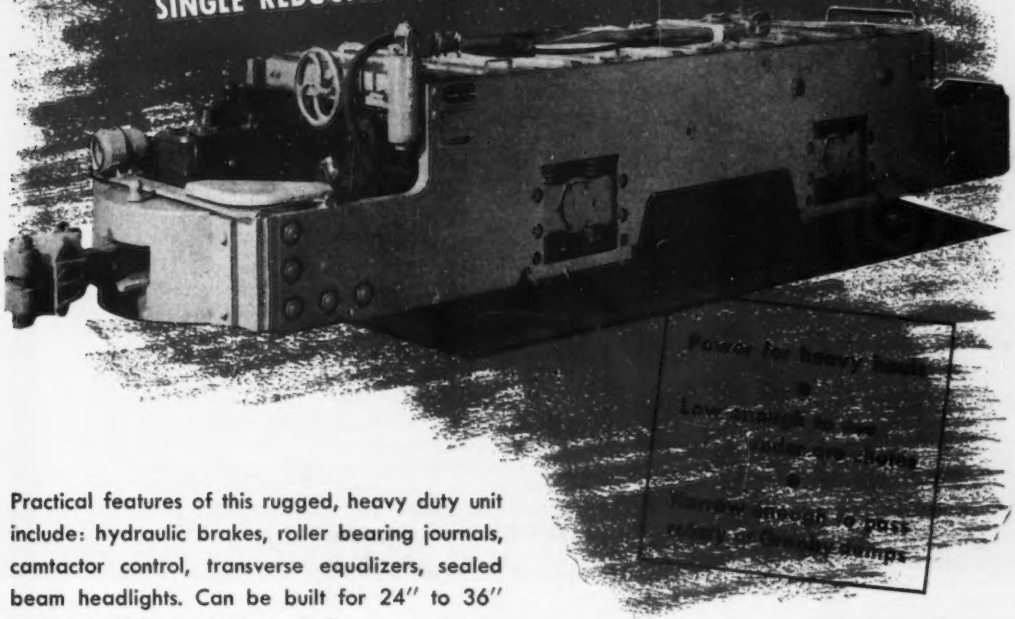
PRESSED STEEL CAR COMPANY, Inc.

Export Division, 25 Broad Street, New York 4, N. Y.

new!

GOODMAN 10 TON METAL MINE LOCOMOTIVE

WITH TWO 60 HP MOTORS; SINGLE REDUCTION SPUR GEAR DRIVE FOR 24" GAUGE



Practical features of this rugged, heavy duty unit include: hydraulic brakes, roller bearing journals, camtactor control, transverse equalizers, sealed beam headlights. Can be built for 24" to 36" gauge or 30" convertible to 24".

plus

full protection for electrical units and motors against water and muck—customary Goodman construction for metal mine service.

Goodman locomotives in trolley, storage battery and combination types cover the entire range of metal mine service. Let us help you select the Goodman locomotives which meet your particular mine conditions.

Goodman MANUFACTURING COMPANY

HALSTED STREET at 48th • CHICAGO 9, ILLINOIS

HOW CAN A COUPLER BE SO TOUGH?

In hard haulage service, this O-B Automatic Coupler meets every requirement for strength and utility.

How do O-B Couplers stand up to the repeated whacks and jolts encountered in a mine car haulage system? To some, it must seem that any coupler has to give sooner or later, for the punishment is terrific. But O-B Coupler owners know that O-B Couplers won't knuckle down under any sort of rough treatment, and one of the reasons is because of the tough rubber draft gear.

The rubber buffing pad and the rubber pulling pads in the O-B Form-8 Coupler can absorb impacts of as much as 100,000 pounds. These pads, shown in the exploded coupler illustration, occupy less space than steel springs, are more resilient, and are not susceptible to the deteriorating effects that steal the strength of steel springs.

Tough, durable O-B Couplers will improve the operation and maintenance of your haulage system. Less time needed for car handling, safer handling, fewer repairs and longer car life are some of the advantages gained from O-B Automatic Coupling. An O-B engineer is ready to study your system and its needs. Let him help with your planning for improved haulage.

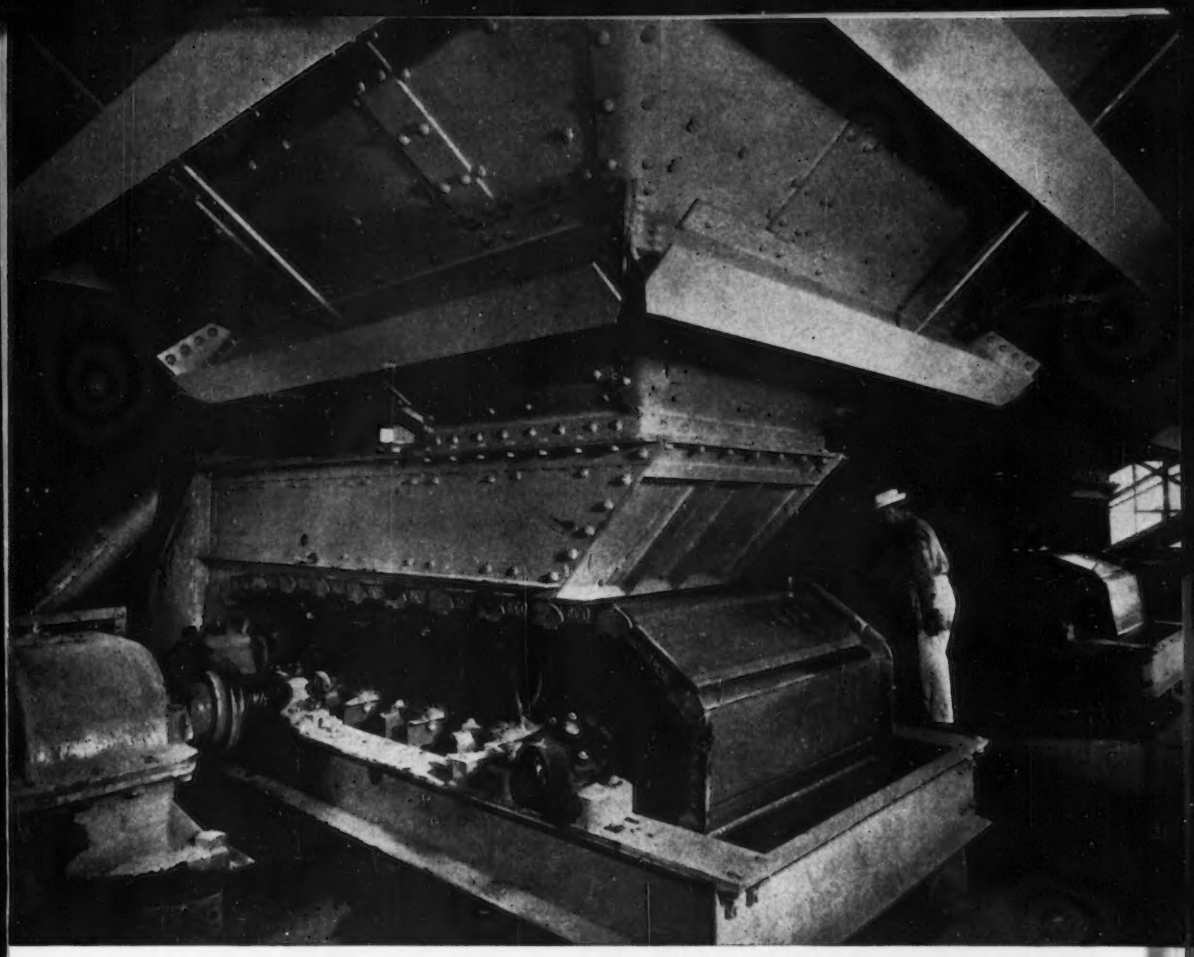
Ohio Brass

MANSFIELD OHIO, U. S. A.

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

Four 1-inch bolts furnished by customer
Rubber Buffing Pad
Clevis
Pin
Rubber Carrier Spring
Back Plate with holes and receptacle furnished by customer
Rubber Pulling Pads
Front Plates furnished by customer
Tail Piece of coupler head

4097-M



An installation of two identical "AMSCO" Manganese Steel Feeders. These rugged machines have 8 foot centers, 4 foot wide pans . . . handle ore at maximun rate of 700 tons per hour.

Built to Thrive On the Toughest Diet!

AMSCO FEEDERS COMBINE THE BEST OF S-A ENGINEERING AND EQUIPMENT

Stephens-Adamson construction and design are at their best in "AMSCO" Manganese Steel Feeders. They are designed to control the flow of material and deliver the load to conveyors or other equipment in regular, uniform volumes, without under or over loading.

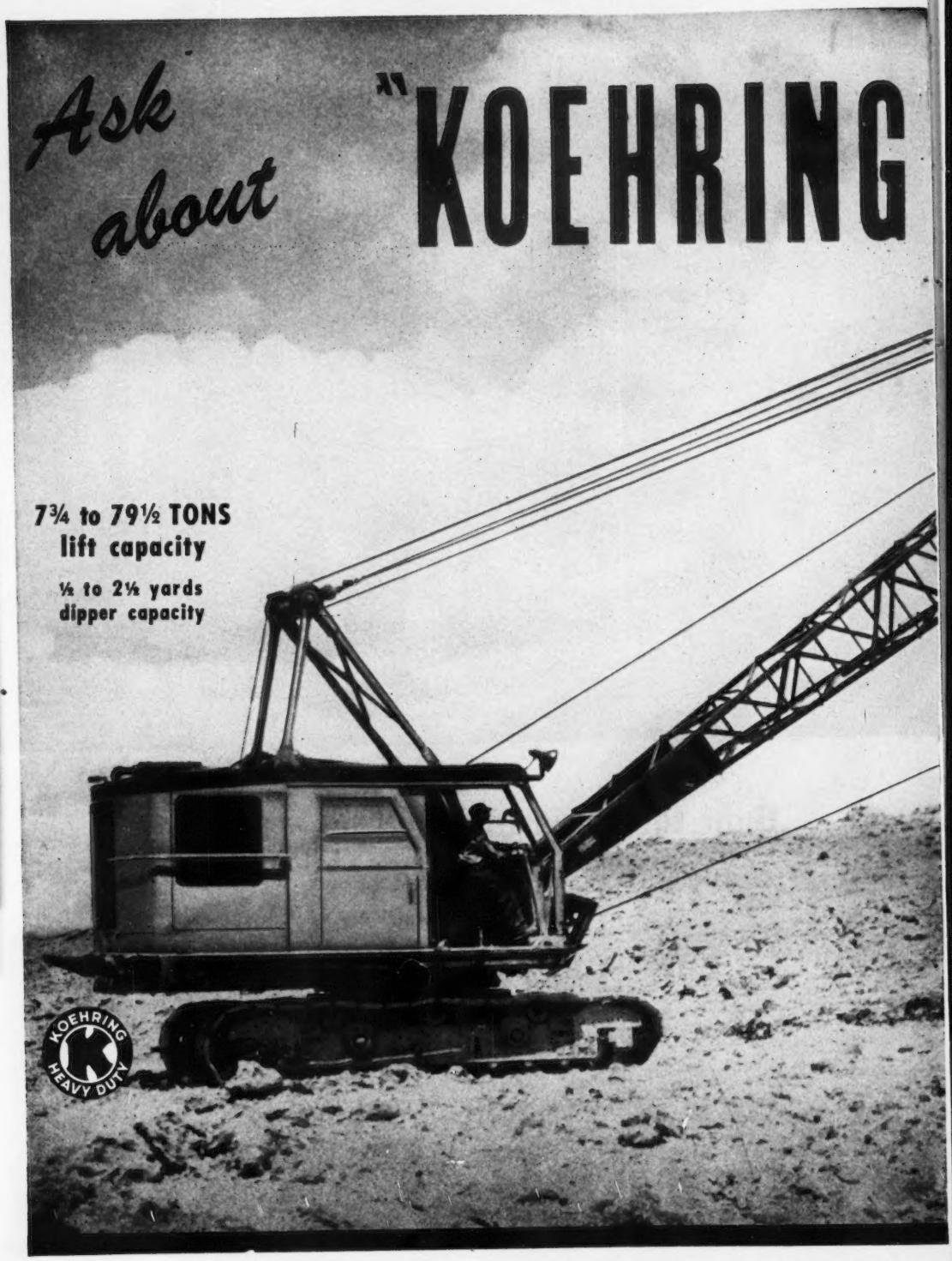
Ruggedly built, whole carloads of heavy ore can be dumped on them—the manganese steel castings actually get tougher with age. Units can be designed to handle up to 3,000 tons per hour and even more.

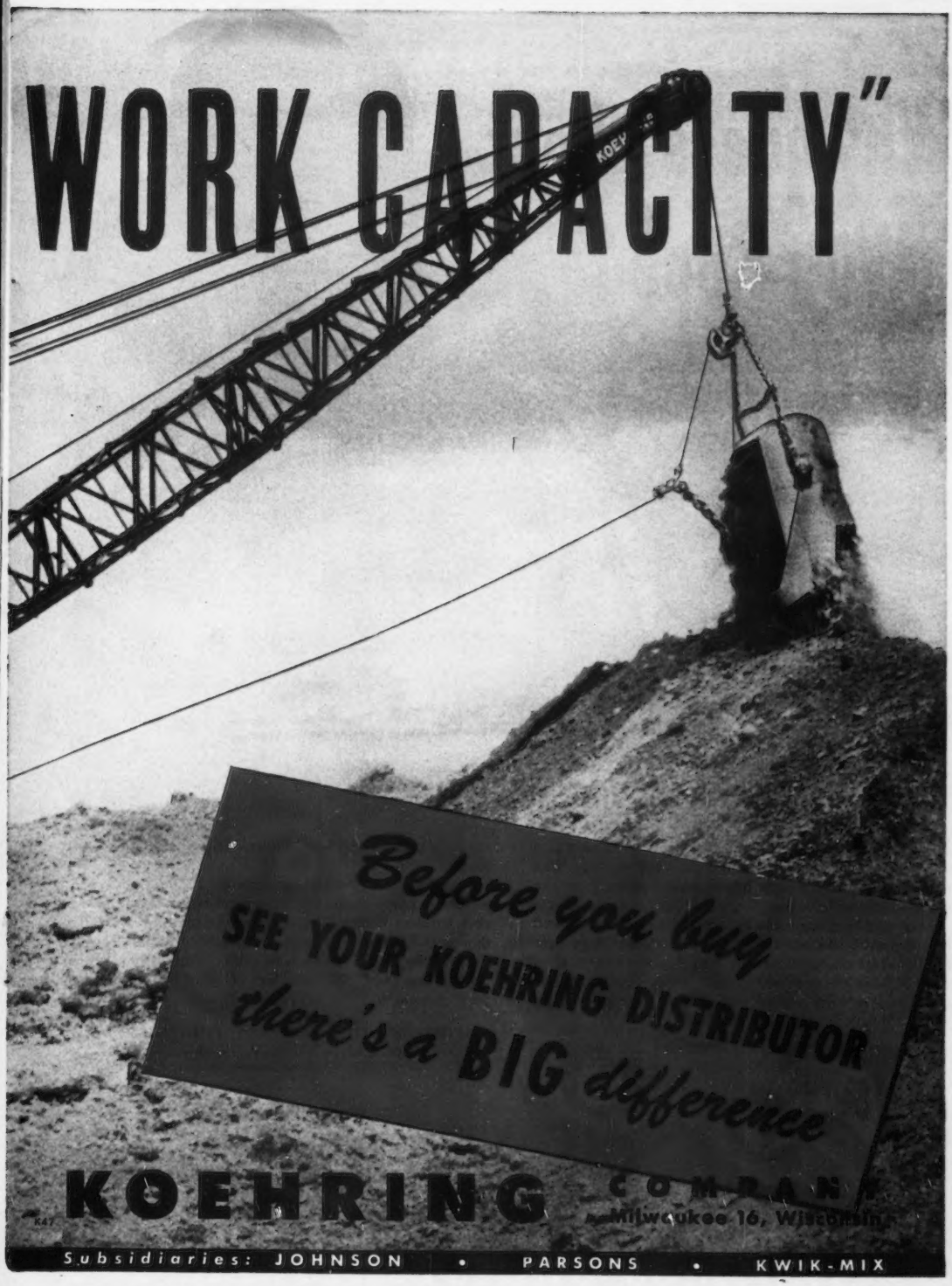
"AMSCO" Feeders are part of the S-A Material Handling Machinery line—a line that includes *all* the items needed to put a planned layout into operation. Full information on S-A equipment and S-A engineering service is available.

STEPHEN S-A DAMSON
MFG. CO.

4 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of
BULK MATERIAL HANDLING EQUIPMENT


Ask about
KOEHRING
7¾ to 79½ TONS
lift capacity
½ to 2½ yards
dipper capacity
KOEHRING
HEAVY DUTY


WORK CAPACITY"
Before you buy
SEE YOUR KOEHRING DISTRIBUTOR
there's a BIG difference
KOEHRING COMPANY
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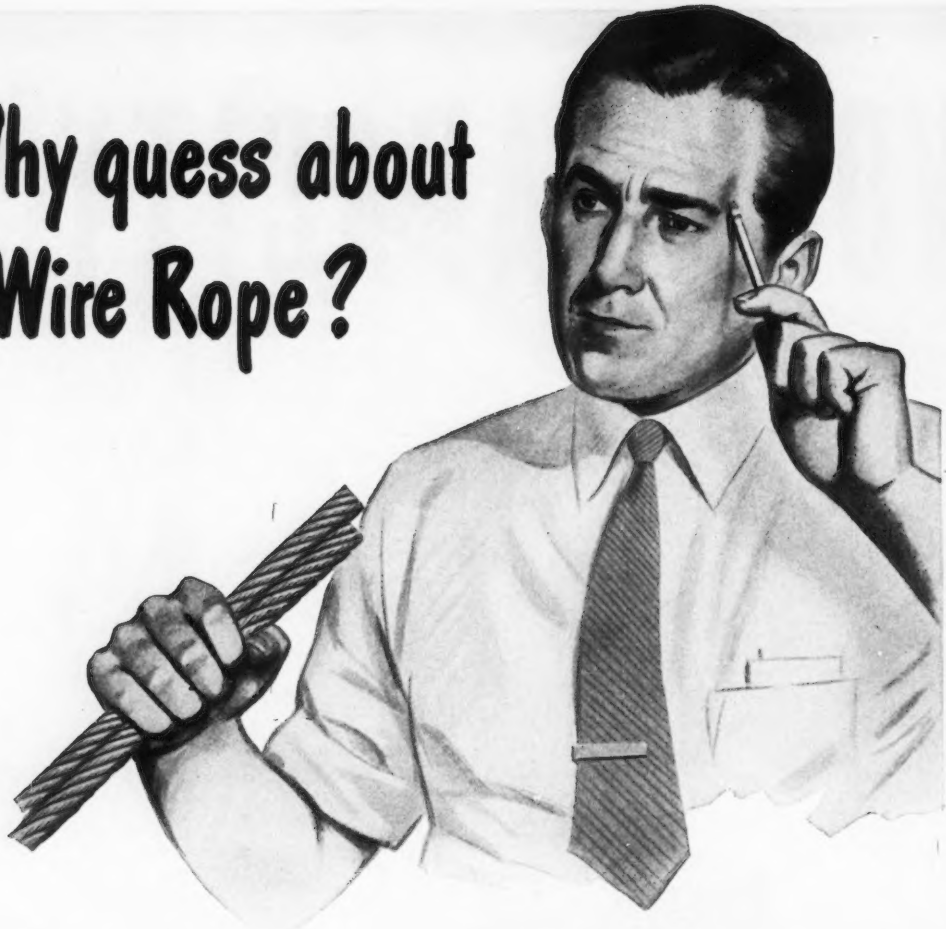
Subsidiaries: JOHNSON • PARSONS • KWIK-MIX

Why guess about Wire Rope?



Let's call this a picture of a man who used to guess about his wire rope. He often guessed wrong. Was never really sure which brand was costing him the most—and the least.

Now he's keeping records. A Bethlehem man showed him the value of knowing what he was actually getting for his rope dollar. Showed him that the true cost of wire rope is the cost per unit of work—per ton-mile, cubic yard of rock moved, etc. Showed him how easily records could help him determine this cost per unit of work.

It's something Bethlehem strongly recommends, for purchase price alone is a false yardstick of rope value and rope economy. Frankly, we welcome any steps that will help users compare brands of rope, for the Bethlehem product is built to give outstanding service at very low cost. This is a fact you can prove to your own satisfaction by keeping a few simple records.

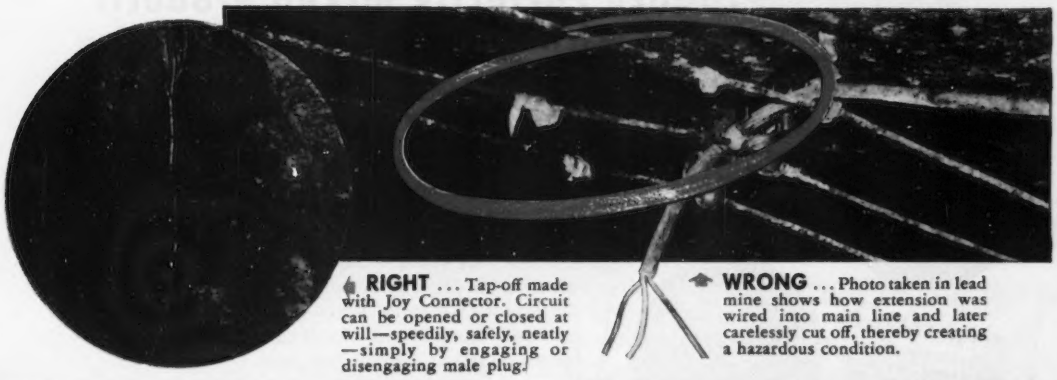
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Get maximum safety and service life at minimum cost

WITH JOY ELECTRICAL CONNECTORS

CONVENIENT • FLEXIBLE • ECONOMICAL



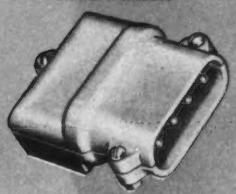
RIGHT ... Tap-off made with Joy Connector. Circuit can be opened or closed at will—speedily, safely, neatly—simply by engaging or disengaging male plug.

WRONG ... Photo taken in lead mine shows how extension was wired into main line and later carelessly cut off, thereby creating a hazardous condition.

OVAL STYLES
Also available with 3 contacts

Female Portable

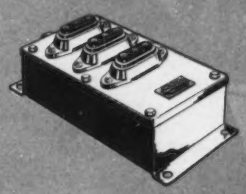
Female Wall Receptacle



Male Machine Receptacle

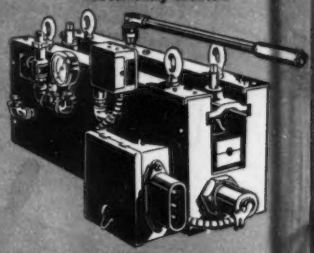
Male Portable

GANGS
#E137 Gang



For power tap-offs from single feeder to a variety of operating equipment. Available in 2, 3, and 4 outlet styles. Input fitting threaded for conduit.

CABLE JACKET VULCANIZERS
Electrically Heated



Electric immersion type heaters generate steam for heating mold. Heat control is fully automatic. Has safety "pop-off" steam valve. Available in five standard sizes.

MOLDS AVAILABLE FOR ALL STANDARD CABLE SIZES

Dangerous, makeshift wiring installations can be eliminated with the use of Joy Electrical Connectors. Of one piece molded Neoprene construction, Joy Connectors are watertight and shatter-proof—impervious to adverse climatic or mining conditions. Oils, acids, alkalies or moisture have little effect on their life span or conducting efficiency.

All Joy Connectors are supplied with lengths of cable as specified by the customer. Each Connector is permanently attached to its cable through "taper-neck" vulcanization—a process that provides additional strength at this vital point. When fully engaged, contacts are completely enclosed in a waterproof Neoprene housing.

For an easy and economical solution to your wiring problems try Joy Electrical Connectors. A wide variety of types and styles is available—each designed for maximum safety, economy, and trouble-free service.

An attractive new Joy Bulletin, No. MC-109, available upon request, describes this equipment in detail.

Write for Bulletins, or *Consult a Joy Engineer*

W&D ME 3554

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

STURTEVANT

Dustless BLENDERS

Produce Perfectly Mixed Products with NO Loss of Materials

RECEIVING

The ingredients to be mixed enter the mixing chamber of the drum through a chute. Note scoops which carry up and dump the ingredients as the drum rotates.

DISCHARGING

By simply throwing a lever, the inlet is closed and the mixer is in discharging position. The completely mixed materials drop off the lifting scoops and discharge through chute without segregation of ingredients.

Four-way mixing action produces homogeneous blends. No matter what the densities, weights, finenesses or other physical properties of the ingredients, Sturtevant Dustless Blenders provide *a thoroughly blended product* with no substances floating to remain unmixed. Sturtevant advantages include—single opening for both receiving and discharging . . . "open door" accessibility for quick, thorough cleaning . . . rugged construction for long life and minimum maintenance. Sturtevant Dustless Blenders are available in mixing capacities from 500 to 20,000 pounds. Write for information or engineering assistance.

STURTEVANT MILL COMPANY
100 CLAYTON STREET, BOSTON 22, MASS.

Designers and Manufacturers of

CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

MORE MILES OF MOTION

Homocord CONVEYOR BELTS

Round and round—up and down they go, taking the hard impact of heavy loading . . . and still coming back for more . . .

Users tell us there are more ton-miles of rugged service in Homocord Conveyor Belts than in any other. This is not accidental; we engineered Homocord specially for heavy duty conveying. It cushions load-impact. It troughs naturally, needs less training. It's flexible, yet it's strong.

Bulletin 6906, mailed on request, presents convincing proof.

Our hose, V-belts and flat belts, too, are engineered for extra long life. Ask your R/M Representative.

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

piping repairs *cost more* now!

No. 488 Iron Body Clamp Gate

You make them less often by using Dependable Quality

CRANE VALVES

...That's why more Crane Valves are used than any other make

easy access prevents trouble with this valve

Remove just two nuts to dismantle this gate valve for inspection, cleaning, or repairs—without taking it from the line. Reassemble just as easily, knowing that Crane clamp design keeps the bonnet joint snug and accurately aligned. Use Crane Clamp Gates on steam, water, and air, but especially in heavy fluid lines needing periodic cleanout. They'll save time, labor, and encourage regular servicing that prevents valve trouble.

Combining easy access with highly dependable service features, Crane Clamp Gates typify Crane Quality—*better valve performance at lowest ultimate cost.*

CRANE

CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

MORE AMPERES CAN RIDE THESE CABLES

You can do yourself and our country a service by installing Simplex-ANHYDREX XX Cables wherever you need to replace high voltage power cable.

Here's why. You can crowd more amps into the same size copper when it is insulated with Simplex-ANHYDREX XX. That's how you save copper. Of course your cables will run hotter but that's all right with Simplex-ANHYDREX XX insulation. This insulation is built to withstand 75°C. to 80°C. (167°F. to 176°F.), depending on operating conditions.

Simplex-ANHYDREX XX Insulated Cables can be used underground, directly in the earth, or in ducts, or they can be used overhead as aerial cables. The special Simplex neoprene jacket protects these insulated conductors from sunlight, oil, acids, alkalies, etc.

Want to know more about this versatile high temperature, high voltage power cable insulation that really combats moisture and water? Then return the coupon. No obligation, of course.

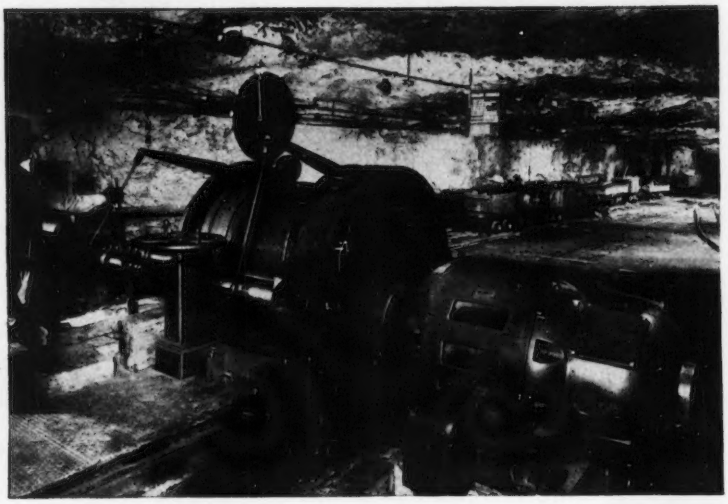
Simplex-ANHYDREX XX is a product of Simplex Research

SIMPLEX WIRES & CABLES

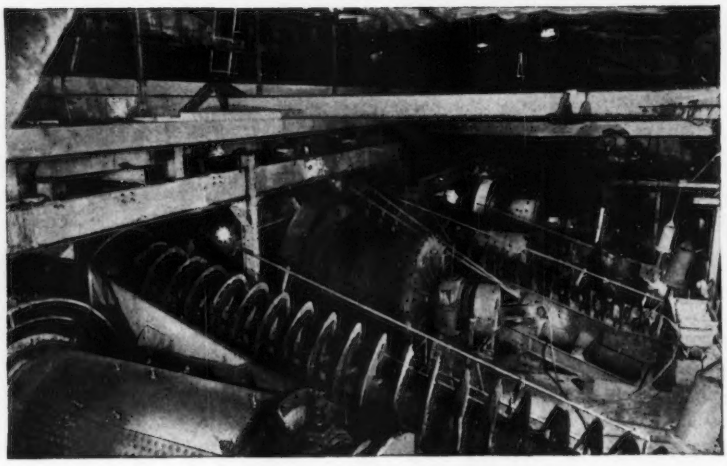
SIMPLEX WIRE & CABLE CO.
79 Sidney St., Cambridge 39, Mass.

SIMPLEX WIRE & CABLE CO.
79 SIDNEY ST., CAMBRIDGE 39, MASS.
GENTLEMEN: PLEASE SEND A COPY OF BOOKLET 1009A TO:
NAME_____ TITLE_____
COMPANY_____
STREET_____
CITY_____ STATE_____

Underground lead-zinc mill hits 1200 tons per day!



1 Hauling cars of lead-zinc ore up 15° slope to the underground mill is this 72" drum hoist, driven by G-E 300-hp 440-volt motor and control. Only one of its kind, the Gilman lead and zinc mill was built entirely underground because in the mountainous terrain surrounding it there is not enough level country. Several hundred feet down, in rooms cut out of hard rock, crude ores from the adjacent mine are concentrated for smelting at distant plants.



2 In the underground grinding room, two 100-hp and two 75-hp 440-volt G-E motors and control drive grinding mills. Classifier drives consist of four 10-hp G-E motors and control. Naturally heated to 83F, water for grinding process is pumped from mine to mill by G-E induction motors.

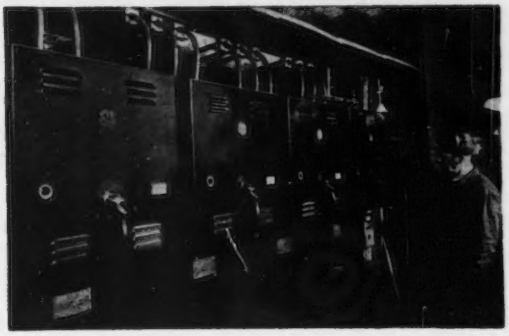
GENERAL ELECTRIC

660-23

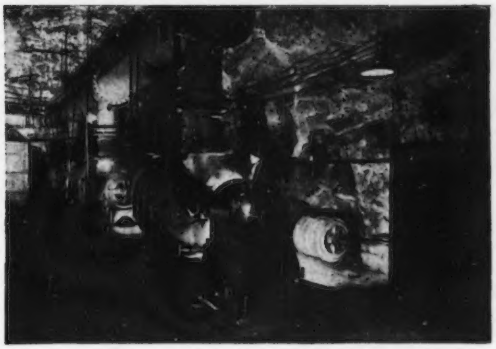
Co-ordinated G-E drives and distribution equipment help maintain continuity of production at New Jersey Zinc's unique Gilman, Colo. concentrating plant

5 **Power for the mine** comes down from the surface at 13,800 volts through 4500 feet of G-E armored cable. At this substation—comprising a G-E switchboard and three 150-kva Pyranol† transformers with gas absorbers—it is stepped down to 440 volts for utilization throughout the mine's two lowest levels.

3 **Grouped motor control** is provided at several points throughout the mill by compact G-E Cabinetrol* units. Space-saving Cabinetrol "packages" include all controls and instruments needed for various milling processes. This neat assembly, together with its associated push-button stations, is located in the mill's flotation cell room.



6 **To protect equipment** against damage from excessive overcurrents caused by heavy overloads or short circuits, the mill uses four G-E 3-pole air circuit breakers rated 600 amperes, 600 volts. G-E air-circuit breakers, selected for adequate interrupting capacity, help safeguard against loss of production in all milling operations.



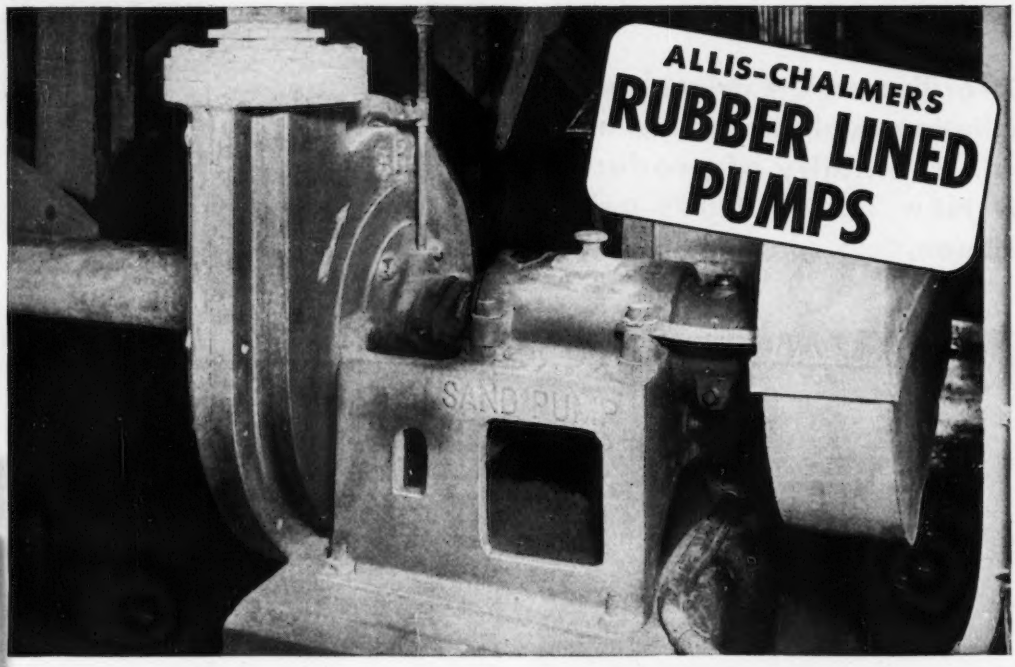
4 **After grinding the ore,** lead minerals are separated from zinc minerals and waste, and then zinc minerals are separated from waste tailings in flotation cells. Air for flotation cells is supplied by these blowers, driven by three 125-hp 440-volt G-E a-c motors, with G-E control at right.

*Reg. trade mark of General Electric Co. for enclosed control panel equipment.

CO-ORDINATED EQUIPMENT
for the Mining Industry

At every stage in ore processing—mining, concentrating, smelting, or refining—a G-E mining industry specialist can help you solve your electrical problems efficiently, economically. He's a good man to know. Call him soon! *General Electric Company, Schenectady 5, N. Y.*

†Registered trade mark of General Electric Co. for askarel.



Gives You 4 Big Economies In Handling Fine Mesh Materials

1. **Long Life** — Rubber compounds especially made for each application provide from 10 to 50 times the wear resistance of the hardest metals on such jobs as pumping tailings, classifier overflow, grinding mill discharge and other operations involving hard, abrasive materials of ⅛" to 325 mesh size.
2. **Easy Servicing** — The rubber casing liner is completely separate from the casing. It may be removed and replaced without moving the pump itself. The impeller is screwed onto the shaft and also may be removed easily. Thus, a complete supply of spare parts may be kept on hand at moderate cost. Neither standby pumps nor long shutdowns for pump rehabilitation are required.
3. **Flexibility In Operation** — The Allis-Chalmers Rubber Lined Pump is usually driven by a *Texrope* V-belt drive. Its head and capacity may be varied considerably by simply changing the speed of the drive. Where changes are frequent, the *Vari-Pitch* Automatic sheave provides instant speed control at very moderate cost.
4. **Application Engineering** — Each job is individually engineered by a competent Allis-Chalmers application engineer who is familiar with solids pumping problems. You can be sure of exactly the right pump and exactly the right materials for lowest cost per ton pumped.

Get full details on what the Allis-Chalmers Rubber Lined Pump can do for you. Call your A-C District Office or write Allis-Chalmers, Milwaukee 1, Wisconsin, and ask for Bulletin 08B7311. A-3347

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

You SEE the saving!

Above: **EASTON BD hydraulic drop door truck bodies for rugged, versatile duty on earth, rock and ore moving jobs.**

•

Below: **EASTON TP pan type side-dump trailers for big payloads at low cost in shovel-to-crusher hauling.**

•

Investigate these and other EASTON side-dumps. Capacities are limited only by the truck chassis of your choice.

Watch that smooth side-dump action!

You *roll up, dump* and *roll on!* Side-dumping cuts out needless backing and turning. You can see the saving in time, money, effort!

B-1046

Get the facts straight from headquarters — from EASTON side-dump engineers!

EASTON
Side-Dumps

Easton Car & Construction Company, Easton, Pa. • Headquarters for Side-Dump Cars, Truck Bodies and Trailers

OCS*

Killer of Many Belts before their time

*Overcured Sections — present every 30′ to 40′ in all belts made by the flat press method. Only Rotocuring eliminates this major cause of belt failure.

...but you won't find this common cause of failure in BWH ROTOCURED BELTS!

In the flat press method of curing, a segment of the belt is double cured every 30 to 40 feet. These overcured segments of 2″ to 4″ in width across the entire belt can't be avoided in flat press curing because the previously cured sections are advanced each time less than a full press length. Result: a number of structurally weak, failure-inviting segments (the exact number depending on the length of the belt).

With BWH ROTOCURED belts there are no overcured segments because the vulcanization is *continuous*. You as a belt user benefit *4 ways:*

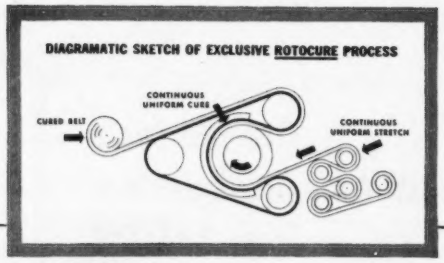
1 You get uniform, abrasion-resistant covers *overall.*

2 You get improvement of flex life up to 40%.

3 You get no mechanical distortion (inherent with flat press curing at the press ends).

4 You get constant uniform stretch *always.*

These product advantages are why BWH ROTOCURED conveyor belts last longer, require less maintenance and lower the cost per ton of material conveyed. You get them too in BWH transmission belts, plus a higher coefficient of friction (no dusting agents required with Rotocure—hence tensions are minimized and belts last longer). Call in your BWH distributor or write us direct for complete details.



BWH DEPENDABLE RUGGEDNESS

Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all Principal Cities

PLANT: CAMBRIDGE, MASS. • P.O. BOX 1071, BOSTON 3, MASS., U.S.A.

ALL ROPES *look* ALIKE... but

CLOSER TOLERANCES MAKE THE DIFFERENCE

One-third the thickness of this page—that's the accuracy tolerance we insist on for wire that goes into the making of Wickwire Rope. Wire that doesn't meet this close tolerance is rejected. On finer sizes of Wickwire rope wire, tolerances are even closer, amounting to about one-sixth the thickness of this page.

Such unrivalled precision control over the uniformity of rope wire diameter is not apparent to the naked eye, but *how* it does show up in the superior rope performance and dollar savings you get with Wickwire Rope. Numerous other exacting tests, coupled with the know-how of 52 years experience, explain why Wickwire Rope gives you the utmost in uniformly dependable performance ...longer, more economical service on the job.

Wickwire Rope is available in all sizes and constructions, both regular lay and Wisscolay Preformed. See your nearest Wickwire distributor for the *right* rope for your particular needs. For your free copy of "Know Your Ropes," write to Wire Rope Sales Office, Wickwire Spencer Steel Division of C. F. & I., Palmer, Mass.

LOOK FOR THE YELLOW TRIANGLE ON THE REEL

WICKWIRE ROPE

CF&I
& SUBSIDIARIES

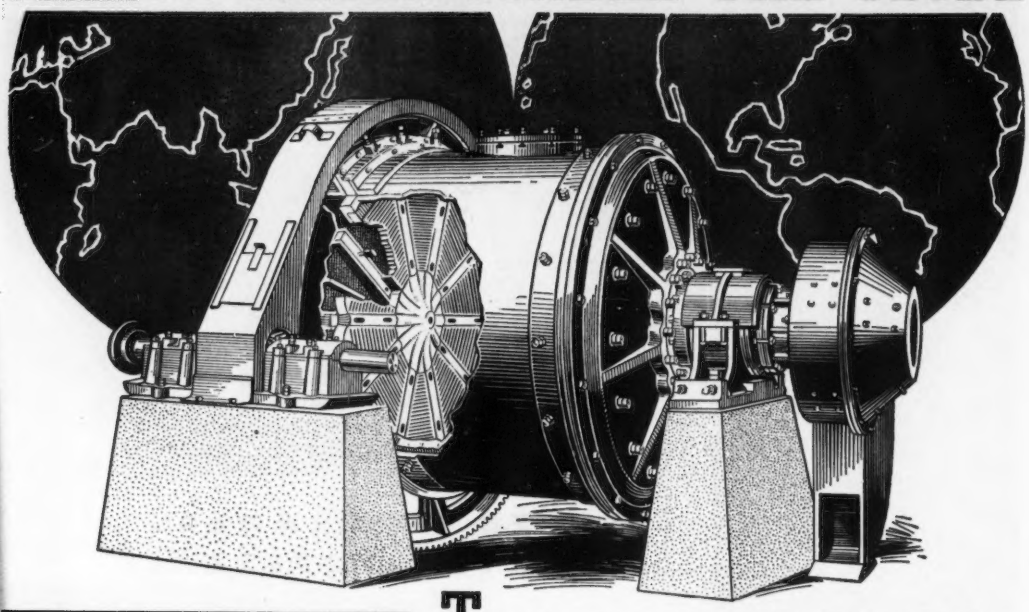
A PRODUCT OF THE WICKWIRE SPENCER STEEL DIVISION OF THE COLORADO FUEL AND IRON CORPORATION

WIRE ROPE SALES OFFICE AND PLANT—Palmer, Mass. · **EXECUTIVE OFFICE**—500 Fifth Avenue, New York 18, N. Y.

SALES OFFICES—Abilene (Tex.) • Boston • Buffalo • Casper • Chattanooga • Chicago • Denver • Detroit • Emlenton (Pa.) • Houston • New York Odessa (Tex.) • Philadelphia • Phoenix • Salt Lake City • Tulsa

PACIFIC COAST SUBSIDIARY—The California Wire Cloth Corporation, Oakland 6, California

MARCY MILLS GIRDLE THE GLOBE



633 OUTSIDE U. S. A.	
Alaska	11
Canada	153
Mexico	89
Cuba	9
Latin Amer.	163
Europe	94
Africa	34
Far East	43
Philippines	37

Many of these are repeat orders

THE wide acceptance of Marcy Mills both in the United States and in the far corners of the world is based upon certain principles of design and operation.

In an open-end Marcy Mill the difference in elevation between the incoming feed and the lower point of discharge causes the fines to travel faster than the coarser particles. Thus the finished material is removed more quickly, better exposing the coarser material for further grinding.

With impact on a smaller body of ore, maximum drop for impact and far less cushioning, more rapid grinding is effected. Obviously, in closed circuit grinding in open-end Marcys there are many more circuits per hour. Equally obvious are the accruing advantages of increased tonnage, lower per ton cost and more satisfactory metallurgy in any subsequent flow-sheet operations.

● Permit us to present field records which substantiate these statements.

Denver, El Paso, Salt Lake City, 1775 Broadway, N. Y.
Canadian Vickers, Ltd., Montreal; W. R. Judson, Santiago & Lima
The Edward J. Nell Co., Manila, P. I.

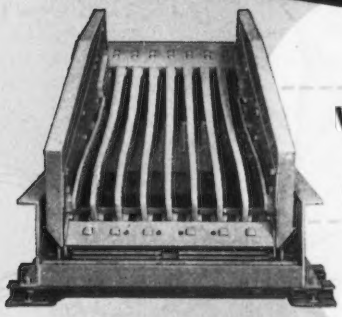
Massco Fahrenwald Flotation Machines; Genuine Wilfley Tables; Massco-McCarthy Hot Millers; Rock Bit Grinders; Density Controllers; Belt Feeders; Pinch Valves; Assay and Laboratory Supplies and Equipment; Complete Milling Plants; Constam Ski Lifts.

The Mine & Smelter Supply Co.

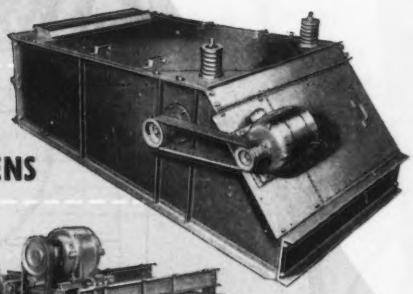
SYMONS SCREENS

for most applications . . .

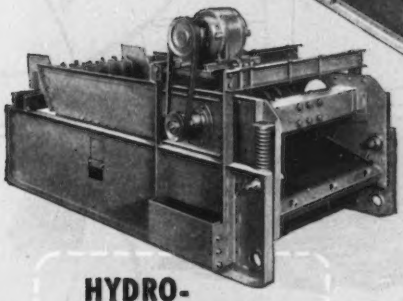
from PRIMARY SCALPING down through the FINER SEPARATIONS



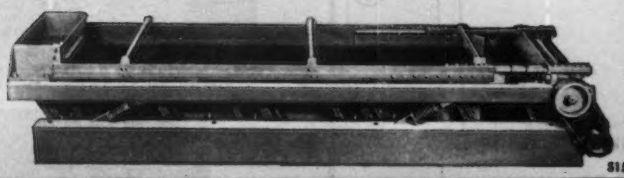
VIBRATING BAR GRIZZLIES



ROD DECK SCREENS



HYDRO-SIZER SCREENS



HORIZONTAL SCREENS

For sizing operations, Nordberg offers a broad line of Symons Vibrating Screens and Symons Vibrating Bar Grizzlies in a wide range of sizes to meet practically every problem. Here are the "highlights" of the units illustrated:

Symons Vibrating Bar Grizzly . . . for scalping coarse materials, designed to assure non-clogging action with big capacity.

Symons Rod Deck Screen . . . employs a patented screen deck, utilizing replaceable spring steel rods. Features low screening cost—big capacity—low maintenance—long life—ideal for wet and sticky materials.

Symons Hydro-Sizer Screen . . . for fine mesh, wet screening of sand, mill pulps, oil well mud, chemicals, etc.

Symons Horizontal Screen . . . unsurpassed for accurate sizing of stone, gravel, slag, coal and ores. (Fully enclosed units available for efficient "hot plant" asphalt operations). Built in a variety of deck combinations, permitting a wide range of sizes to be handled.

Write for descriptive literature covering the type of unit in which you are interested.

NORDBERG MFG. CO.
MILWAUKEE 7, WISCONSIN
NEW YORK • SAN FRANCISCO • WASHINGTON • SPOKANE
MEXICO, D. F. • LONDON • TORONTO • JOHANNESBURG

5151

NORDBERG

Machinery for processing ores and industrial minerals

PRIMARY CRUSHERS

SYMONS CONE CRUSHERS

ROTARY KILNS

GRINDING MILLS

MINE HOISTS

DIESEL ENGINES

He's safe. In either open pit or underground mines, the Westinghouse Ground Fault Protector, mounted at lower left on the auxiliary transformer skid, prevents injury to men and damage to machinery.

Westinghouse

EQUIPMENT FOR THE MINING INDUSTRY

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

DOES YOUR MINE HAVE ADEQUATE GROUND FAULT PROTECTION?

IT PREVENTS INJURY, SPOTLIGHTS TROUBLE

Unprotected ground faults are dangerous. They can gravely injure men who touch equipment served by a faulted feeder. They result from electrical troubles that can damage machinery and cause shutdowns. Ask yourself two questions: Are the high-voltage circuits that supply your shovels or draglines adequately protected? Are you overlooking the danger in *auxiliary* circuits that serve drills, pumps, etc.? If you're in doubt, your Westinghouse representative can be a big help.

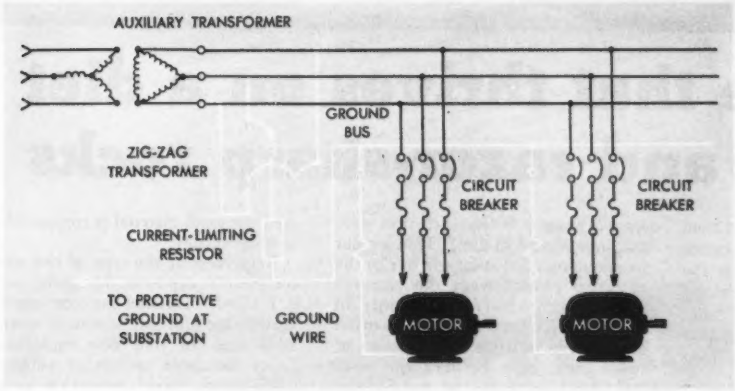
NOW—AUXILIARY CIRCUIT PROTECTION

Westinghouse has supplied high-voltage protective equipment for many years. Now, in answer to industry requests, Westinghouse offers a Ground Fault Protector for *auxiliary* circuits. This Protector is low in cost and easy to install. You bolt it to the auxiliary transformer skid and make simple electrical connections. When a fault occurs, the equipment served is immediately isolated. The trouble is then located, corrected and operation resumed. Men and machinery are safe.

HAVE WESTINGHOUSE CHECK YOUR SYSTEM

Call your Westinghouse office and have an engineer *make sure* your high-voltage protective system is adequate. Then have him tell you more about Westinghouse protection for auxiliary circuits. It's good business insurance. J-94850

HERE'S HOW THE AUXILIARY PROTECTOR PREVENTS INJURY



The frame of each of the motors, driving pumps, drills, etc., is connected to the ground wire (white line). If the current in the ground wire exceeds a predetermined safe amount, the circuit breakers serving the affected motors will trip. The faulted section is thus safely isolated and exposed as a trouble spot.

GET MORE INFORMATION NOW ON GROUND FAULT PROTECTION

Westinghouse Electric Corp.
P. O. Box 868
Pittsburgh 30, Pa.

Gentlemen:

Please send me without obligation the following information:

- ☐ Folder B-4747, Ground Fault Protection for Auxiliary Power Circuits in Open Pit Mines and Quarries.
- ☐ Booklet B-3282A, Electric Power Distribution and Protection for Open Pit Mines.

Name_____ Title_____

Address_____

B.F.Goodrich

The tire that thrives on a diet of mud and razor-sharp rocks

TIRES hauling ore-bearing clay from pit to mill in barite mining service lead a difficult life. The tires on the equipment shown being examined above, operated by the Baroid Sales Division of the National Lead Company, Potosi, Mo., have been working under the following routine:

One minute they are backing out on raw clay in the pits — a clay that has the consistency of putty when moist, but like rough stone when dry. Next, they are carrying a twelve-ton load to the mill over a road of flint and quartz — a surface similar to broken razor blades.

Yet, the operators report they have experienced *no road delays due to tire trouble* since B. F. Goodrich tires were put into service in 1947. This big cut in operating costs is largely due to the exclusive protection of the patented *nylon shock shield* found only in B. F. Goodrich tires (with *double* nylon shock shield in larger sizes). Layers of nylon cord, built between the tread and body plies, shield the cord body by smoothly distributing shocks and strains.

These BFG tires have a special deep tread designed for just such service. The BFG Rock tires shown above have wide, continuous-running ribs that give more wear at vital points. The heavy, non-directional cleats on the shoulders give a deep bite in forward or reverse, on moist clay or hard quartz. And the tread material is compounded to resist cutting.

Regardless of the type of tire service your equipment demands, your B. F. Goodrich retailer has a cost-cutting answer. See him and be sure to specify BFG tires for your new equipment. Enjoy the extra savings of patented nylon shock shield protection at no extra cost. *The B.F.Goodrich Company, Akron, Ohio.*

RESEARCH KEEPS
B.F.Goodrich
FIRST IN RUBBER

As the white outline indicates, a standard unit of much greater frame size would be required to do the work of Speedaire.

Speedaire-driven conveyor built by Goodman Manufacturing Company.

Only SPEEDAIRE could do this job!

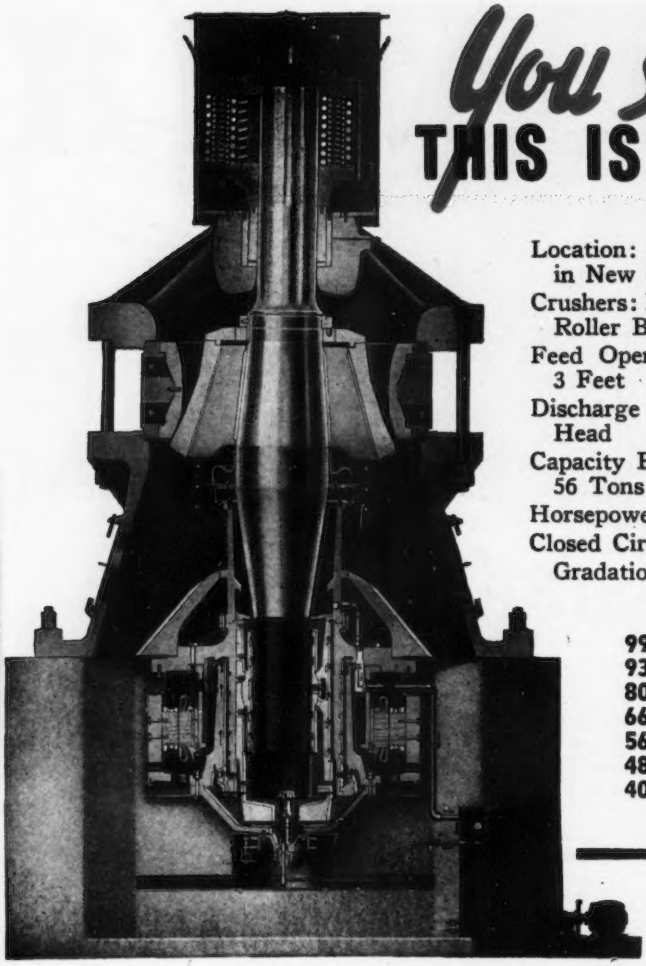
FOUR important factors make Speedaire the only practical drive for this 30" belt conveyor:

1. **Because of cramped quarters underground, a compact, powerful right-angle drive is a must.**
2. **Only 32¼" high, the Speedaire unit is nearly 15 inches lower than a standard worm gear reducer of comparable size—vital for low ceilings.**
3. **This Speedaire weighs 1550 pounds less than a comparable standard unit. Lighter weight facilitates moving conveyor.**
4. **The Speedaire unit costs less than half as much as a standard worm gear drive of equal capacity.**

Speedaire is Cleveland's fan-cooled worm-gear speed reducer. Because it is fan-cooled, Speedaire will do more work—will deliver up to *double the horsepower* of standard worm units of equal frame size, at usual motor speeds. It can be installed economically on many applications where other types have been used heretofore—giving you the advantage of a compact right-angle drive. Speedaire gives the same long, trouble-free service characteristic of all Clevelands.

For full description, send for Catalog 300. The Cleveland Worm & Gear Co., 3281 East 80th St., Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.



You said it!
THIS IS PERFORMING

Location: Nationally known Mining Co. in New York State
Crushers: Four No. 37½ Kennedy type "S" Roller Bearing Gyratory Crushers
Feed Opening: 6¼"; Diameter of Head: 3 Feet
Discharge Setting: 7/32" Closed Side at Head
Capacity Each Crusher: 56 Tons Per Hour
Horsepower Each Crusher: 48 HP.
Closed Circuit Operation
Gradation As Follows:

PERFORMANCE

99.8%	Minus	3	MESH
93.3	"	4	"
80.6	"	6	"
66.6	"	8	"
56.1	"	10	"
48.1	"	14	"
40.6	"	20	"

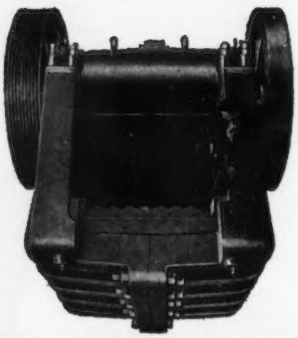
Performance? You said it!

You said it!
THIS IS TOPS IN SWING JAW ACTION

We said: "Less POWER-LOSS in the KVS Swing Jaw Crusher" because the STATIONARY jaw carries 50% of the crushing load, thereby saving power for crushing. Three important points tell more of the economies in this Swing Jaw Crusher:

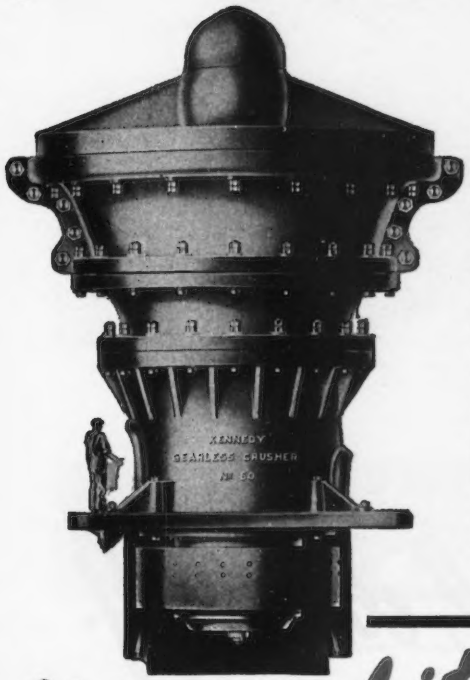
1. Shaft is cast INTEGRAL WITH THE SWING JAW giving low maintenance.
2. Swing and stationary jaw plates are INTERCHANGEABLE, and REVERSIBLE end for end giving longer wear.
3. NO BOLTS pass through the jaw plate—it is held in by keys.

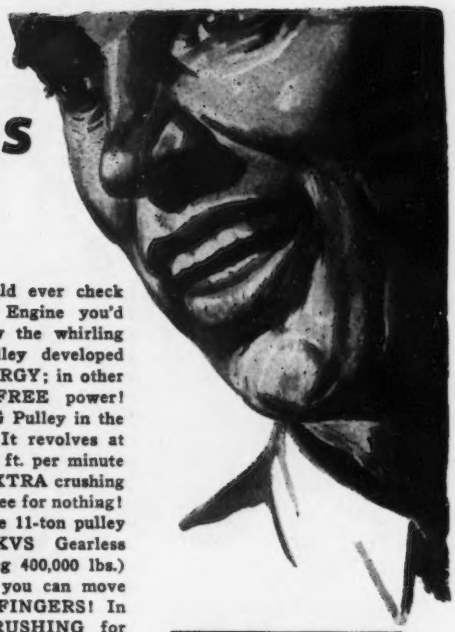
Value plus, you said it.



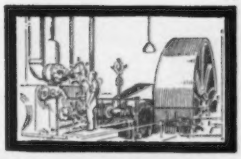
USERS SAY—"KVS PRODUCTS ARE BEST"

You said it!
THIS IS POWER plus



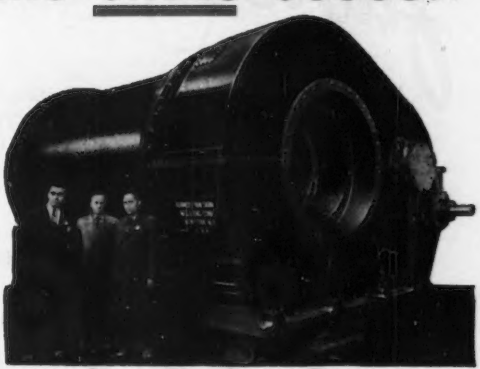


Say, if you could ever check an' old Corliss Engine you'd quickly see how the whirling flywheel or pulley developed KINETIC ENERGY; in other words, added FREE power! So does the BIG Pulley in the KVS Gearless! It revolves at a speed of 3,500 ft. per minute —creates the EXTRA crushing power you get free for nothing! What's more, the 11-ton pulley (used in a KVS Gearless Crusher weighing 400,000 lbs.) turns so easily you can move it with TWO FINGERS! In short more CRUSHING for LESS POWER COST (with less vibration and NOISE), is the big KVS Gearless idea that put the KVS Gearless way out in front and keeps it there. And it makes good—you SAID IT!



You said it! THIS SAVES $5000.!

Like to save about $5,000 on the cost of a 10 ft. tube or ball mill? Buy a KVS MILL with integral gear drive! Because—with this drive, you can use a SYNCHRONOUS MOTOR DIRECT CONNECTED to driving shaft. This is where you make your big saving. Shaft carried in roller bearings that CAN'T be set wrong. Pinion shaft runs about 600 r.p.m. (in other mills it runs about 180 r.p.m.) KVS trunnions on large sized tube and ball mills CARRIED ON OIL. Bearing never wears out, uses little power. All gears and bearings automatically oil-sprayed before mill is started (pat'd.). In 15 years no KVS gears or pinions have worn out on this type mill. A good buy? YOU SAID IT!



Have we Bulletins and Circulars fully describing these KVS products? Will we be glad to send them to you? YOU SAID IT!

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Designed for maximum speed and efficiency in tunnel driving, the new CP G-600 AIR ACTUATED DRILL JUMBO IS AVAILABLE IN single or multiple-boom units. Rail-mounted, it is built for all standard track gauges.

- Unit is readily disassembled and assembled: component parts are handled easily on mine cages.
- Booms are quickly adjustable to any drilling position. Vertical adjustments are made by rotary air actuating motors.
- Dual actuator motor control valves located at end of boom arm permit operation from either side of boom.
- Air to drifter and actuator motor passes through boom, eliminating awkward air hose. Water piping is protected by running under boom air.

For complete specifications write for copy of SP-3026

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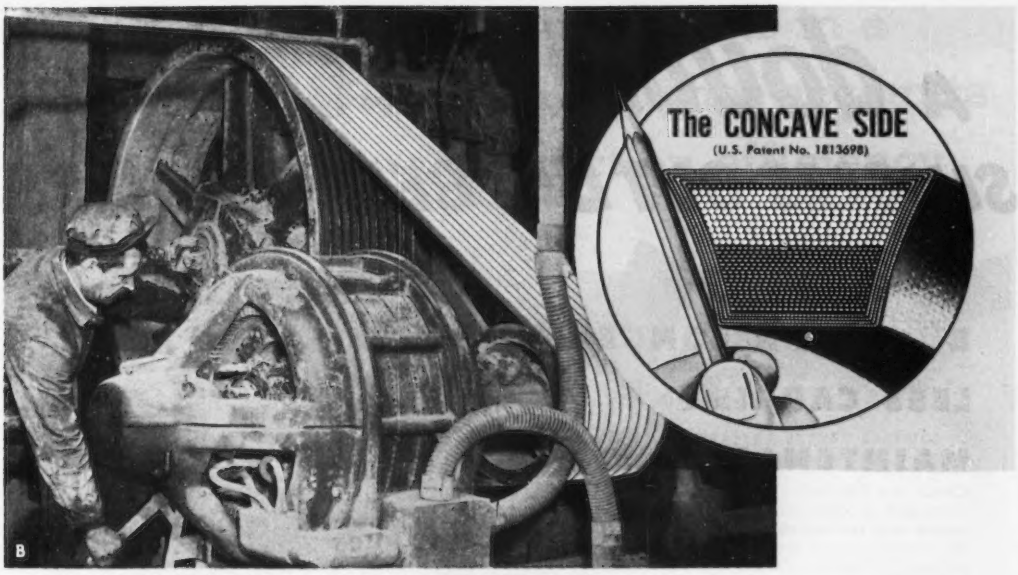


This 36"x 42" jaw crusher of Canadian Quarries, Ltd., Montreal, Quebec, used to be driven by a double reduction flat belt drive. Mr. Pierre Manseau, Master Mechanic, says that the Gates Vulco Rope Drive shown, "has reduced our maintenance costs by about $1000 per year and we were also able to increase production by fifty tons per hour."

This test shows how the Concave Side gives you a real saving in V-Belt costs

If you are interested in lower operating costs, make this simple test:—

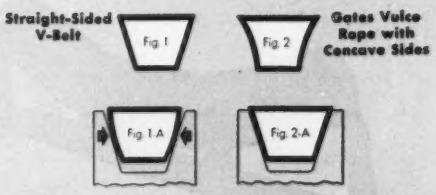
Take *any* V-belt and bend it as it bends in going around a pulley. As the belt bends, grip its sides with your fingers and thumb. You will *feel* the sides of the belt *bulge out!*

This bulging gives a straight-sided V-belt the shape shown in figure 1-A. (See diagrams at right.) Clearly, this shape does not fit the sheave groove. The sides of the bulging belt are forced to press unevenly against the V-pulley—and this concentrates the *wear* along the *middle* of the sides.

But when you bend a V-belt that is built with the *Concave Side*, you find that the sides become perfectly straight—as shown in Figure 2-A. This shape precisely fits the sheave groove.

Because there is *no bulging*, the sides of the Gates Vulco Rope always grip the *full* face of the V-pulley *evenly* and therefore wear *uniformly*—resulting in *longer belt life* and *lower belt costs for you.*

What Happens When a V-Belt Bends



How Straight-Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear At Point Shown by Arrows.

The Concave Sides Fill Out to a Precise Fit in the Sheave Groove. No Side Bulge! Sides Press Evenly Against the V-Pulley—Uniform Wear—Longer Life!

Only V-belts made by Gates are built with concave sides. Whenever you buy V-belts, be sure you get the V-belt with the Concave Sides—The Gates Vulco Rope!

CS-514

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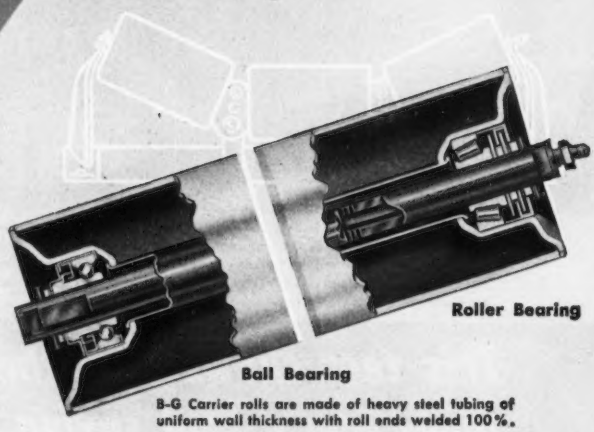
The World's Largest Makers of V-Belts

A double check THAT SINGLES OUT B-G BELT CARRIERS

BUILT FOR LONGER BELT LIFE, LESS CARRIER MAINTENANCE...

Check the B-G Belt Carrier design and you'll find a combination of features that means long, low-cost service. Carrier rolls, for instance, stand out under rigid comparison: ¾" shafts . . . large, high-capacity ball or roller bearings . . . 100% welded and finished hubs . . . labyrinth grease seal . . . all are evidence of highest quality manufacture. Rolls are mounted on a heavy angle steel base with built-in 2° tilt for automatic belt training to assure continued accurate belt alignment and minimum belt wear.

If you are faced with Belt Carrier replacement — or if you're thinking of a new belt conveyor — get the full story on how Barber-Greene Carriers will stay true and smooth-running through more years of service.



B-G Carrier rolls are made of heavy steel tubing of uniform wall thickness with roll ends welded 100%.

OVER 80 STOCKING DISTRIBUTORS

Rolls are mounted on all steel, jig-welded self-shedding angle.

Also, fast, reliable B-G Distributor service can help prevent shutdowns and minimize time lost when conveyor trouble occurs — many carry B-G Belt Carriers in stock, available for fast delivery.

Your B-G Distributor offers carriers in three roll diameters (4", 5", 6")—and in 18", 24", 30", 36" and 42" widths. These as well as impact and self-aligning B-G Carriers are fully described in Catalog 76C. Write for your copy.

Barber-Greene

AURORA, ILLINOIS

Position of the control zone in a Traylor TY Reduction Crusher accounts for its amazing production efficiency

TRAYLOR CURVED CRUSHING SURFACES check lifting and churning of material by applying power as a direct crushing force to obtain a more uniform product on less power-per-ton produced.

TRAYLOR BELL HEAD and CURVED CONCAVES place the crushing zone of smallest volume here, well above the opening where packing and choking commonly occur. Capacities of all succeeding zones are progressively greater . . . *free discharge is assured.*

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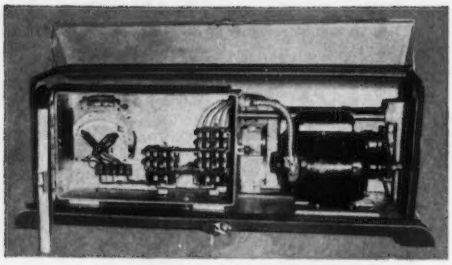

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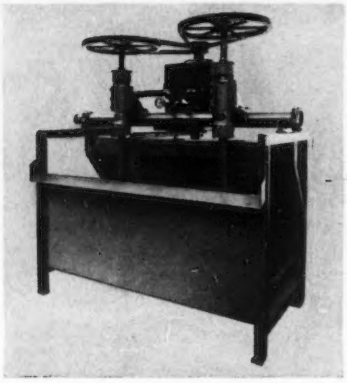
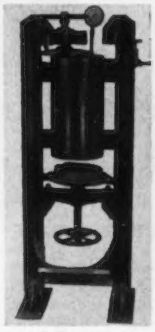
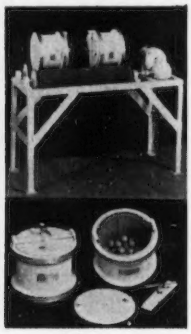


AGITAIR FLOTATION MACHINE



Laboratory Pressure Filter



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All of the equipment shown here functions in the smoothly integrated processes of ore recovery through AGITAIR FLOTATION. Whether your problem is a laboratory setup or installations for mill production, experienced Galigher engineers are at your service for analysis and recommendation. Your correspondence is invited.

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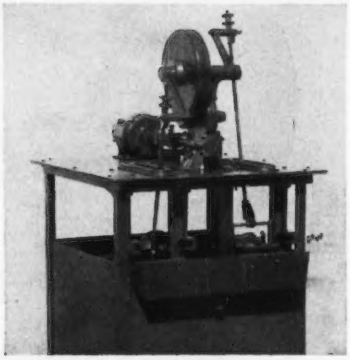
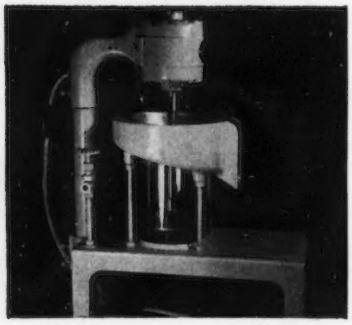


Type "B" GEARY Reagent Feeder



500 Gram Laboratory AGITAIR

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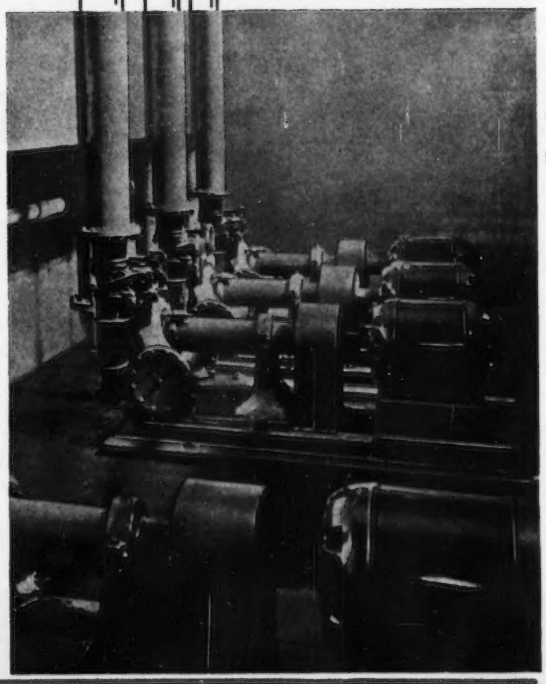

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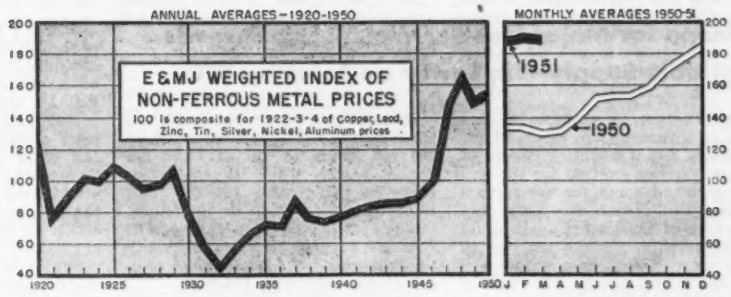
E&MJ OUTLOOK

PRICES



MARKETS

Although **the E&MJ index of non-ferrous metal prices** dipped in March for the first time in 11 months, there's no sag in metal prices in sight. Our index fell to 190.19 in March, from 194.08 in February, only because of the RFC's cut last month at the soaring tin price. (See next page.)

While only brute force holds domestic metal and mineral prices in check, foreign producers busily raise their price tags. **With prices and sales abroad both increasing, U.S. imports of metals are dropping.** A lead control order was the first result of declining imports, and Government bulk-buying for resale at ceilings to U.S. consumers may be the second.

Substitution note: An all-purpose tinless can may be not far off.

IN WASHINGTON

Despite General Marshall's warnings, **a definite lethargy** is slowing the once-furious pace of defense effort. What is ahead for mining?

First, **big purchase contracts** for new projects will be delayed.

Second, **politics** will weigh more heavily in aid to mining.

Third, more help **via price guarantees** to miners of strategic metals like tungsten, which now has a $63 floor guaranteed for next five years. Copper, lead, and zinc probably won't get this broad assistance.

IN THE INDUSTRY

Although it will probably take **bad news from Korea** to put steam back into the defense effort, the mining industry is forging ahead on its own. A recent McGraw-Hill survey showed that mining, including coal, plans to spend about $1.1 billion this year on new plant and equipment, up 45% from 1950.

At least one large mining company has **dropped its application for Government help** and will do its own financing on a new metal project.

Bethlehem Steel was one of the first companies to get quick-amortization tax help. It will open a $34 million iron ore project in Pennsylvania.

Peaceful Note: Tass, the Soviet news agency, just called to ask what E.&M.J. was quoting, in its decadent capitalistic way, on manganese ore.

ABROAD

Peaceful Note No. 2: All the world's free gold markets dropped 5% to 8% in March. If war were in sight, they would have risen.

When International Nickel completes current expansion, it will have **the world's biggest underground metal mine,** hoisting 13,000,000 tons annually.

Canada will spend up to $11 million in subsidies to its gold miners in 1951; terms are to be more liberal to high-cost producers than last year's.

MARKETS—Trends and Prices

Demand for Major Non-Ferrous Metals Exceeds Available Supply—Tin Lower on Sales by RFC

WITH THE CIVILIAN ECONOMY moving along at a rate well in excess of expectations, and a mounting volume of defense business assured for the second quarter, demand for non-ferrous metals during March was active and the wants of fabricators again could not be satisfied. Despite the rise in prices since Korea, mine output has been increasing slowly. The flow of scrap to normal channels of consumption has been slowed down because of an awkward pricing system.

Throughout the first quarter of 1951, the Federal Reserve Board's index of industrial production averaged around 221% of the 1935-39 base period, the highest level since early in 1945.

Scattered price instability in consumer goods failed to disturb the market for non-ferrous metals. In fact, the situation in copper, lead and zinc remained strong throughout March and only the "freeze" kept the lid on prices of these metals. In the so-called black markets, substantially higher prices were paid, particularly by European buyers.

Tin was in a class all by itself, owing to intervention by the Government to force the price down to a more reasonable level. The forced decline in tin in the domestic market depressed the E & MJ price index from 194.06 in February to 190.19 in March, a drop of 3.87 points.

Government Control of Tin

Acting soon after the Senate Armed Services Subcommittee recommended that all buying of tin should be placed in the hands of a single Government agency, the National Production Authority, effective March 12, took over this job. Operating through the RFC, at prices announced daily, consumers were supplied with fair tonnages of tin at prices well below current replacement costs.

A five-nations conference in Washington called to set up a distribution system and stabilize the price of tin ended in failure shortly before the month ended. The stumbling block was price, with producers holding out for a much higher settling basis than that proposed by the representatives of the United States. Handling of the surplus in the stabilization scheme also was an obstacle. Countries participating were Great Britain, The Netherlands, Belgium, Indonesia, and the United States. After the delegates report to their respective Governments it is not unlikely that negotiations will be resumed.

From March 13 to March 28, the RFC maintained its selling basis on the top grade of tin at $1.34 per pound. Shortly after the conference broke up, on March 29, the RFC raised its price to $1.46. On the following day the price rose to $1.50½. The E & MJ average for Straits quality tin for March was 145.808, which compares with 182.716 in February.

NPA announced that molybdenum will be placed under complete allocation beginning May 1. In another order, the molybdenum content of stainless steel will be limited to 2.5%. Demand for molybdenum for the defense program has increased sharply.

Aluminum Set-Aside Up

Effective April 1, the Government increased the set-aside on primary and secondary aluminum for "DO" rated business by 15% to 60% of scheduled monthly production. On the other hand, NPA modified its recent directive limiting production of some 200 items for the civilian economy by allowing manufacturers to consume material already on hand. Production of primary aluminum in February moved up to the rate of 2,241 tons per day, a new high going back to the middle of 1944. Secondary aluminum has been bringing fancy prices, but producers of virgin metal continued to quote the market at 19c. for ingot and 18c. for pig.

Tungsten ore quotations in the domestic market were nominal throughout the month. Makers of the metal and ferrotungsten found their prices frozen under existing regulations and unable to pay the higher prices asked abroad on ore. To halt the rise in London, thought to be more or less speculative, the British Ministry of Supply stepped into the picture, quoted the market at 550s. per long ton unit, equivalent to $68.75 per short ton unit, in bond. Domestic production has been moving chiefly against old contracts. In North Carolina, the leading operator has been holding out for $65 per short ton unit. As March ended it was rumored that NPA and OPA were readying control orders on tungsten. It was rumored that a ceiling of $65 was likely. Demand for tungsten has been worldwide. As high as $90 per unit was quoted in some directions before traders sobered up on the threat of international control of the market.

Copper Import Duty

The House Ways and Means Committee took favorable action on a bill calling for the temporary suspension of the 2c. import duty on copper. The measure provides that the duty is to be suspended from April 1, 1951, to Feb. 15, 1953, providing that for the period named the monthly average price of electrolytic copper does not fall below 24c. per pound, delivered Connecticut. A decline to below 24c. would bring about the reimposition of the duty within 35 days. Favorable action on the bill by both Houses is anticipated.

Supply of copper continued inadequate. Sales in the domestic market during the first quarter averaged more than 100,000 tons a month. Lessened pressure on the market for stockpile metal has brought on no change in the general outlook. A report to the effect that cartridge cases made of steel may cut down military demands for copper attracted attention.

Fabricators shipped products to their customers during February that contained 117,998 tons of copper,

Average Prices for March (E&MJ Quotations)

Copper:	
Electrolytic, Domestics, Refinery	24.200
Electrolytic, Export, Refinery	24.425
Lead:	
Common, New York	17.000
Common, St. Louis	16.800
Silver and Sterling Exchange:	
Silver, New York, per oz.	90.160
Silver, London, pence per oz.	78.500
Sterling Exchange, "Checks"	280.000
Zinc:	
Prime Western, East St. Louis	17.500
Tin:	
New York Straits	145.808
New York, 99% min. (e)	144.808
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$217.333
Antimony (E&MJ) (d)	45.280
Antimony, bulk, Laredo	42.000
Antimony, in cases, Laredo	42.500
Platinum, refined, per oz.	$90.000
Cadmium (a)	255.000
Cadmium (b)	267.500
Cadmium (c)	280.000
Aluminum, 99% plus, ingot	19.000
Magnesium, ingot	24.500
Nickel (f)	50.500

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotation.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lot, packed in cases, f.o.b. New York.

(e) Tin content.

(f) F.o.b. Port Colborne, U.S. duty included.

which compares with 126,660 tons in January and 102,896 tons in February a year ago. Stocks in the hands of fabricators declined from 268,702 tons at the end of January to 248,593 tons at the end of February.

U.S. mine output of copper in February totaled 78,945 tons, which compares with 81,737 tons in January. Output of refined copper in February totaled 101,199 tons, against 110,114 tons in January.

Demand for lead was active and producers again had to allocate supplies of both domestic and foreign origin metal. NPA is expected to act soon to limit consumption. Though the domestic price of primary lead was "fixed" at 17c., New York, secondary metal continued to bring higher equivalents. The smelting charge on battery plates dropped to between $10 and $20 per ton, or near the vanishing point. Foreign buyers paid from 19c. to 20½c. per pound for primary metal, f.a.s. Gulf ports.

Slab zinc was unchanged in price, continuing on the basis of 17½c. per pound for Prime Western, East St. Louis, for the fourth consecutive month. Zinc production from domestic mines in January increased to 59,726 tons of recoverable metal, the highest level attained since April 1949. Imports of both slab zinc and zinc concentrates are falling because of higher prices prevailing in foreign markets. Demand for zinc the world over was in excess of current production.

NPA forbade delivery of platinum to the jewelry industry. It also prohibited all purchases for investment or speculative purposes. The so-called official price held at $90 an ounce troy.

Owing to higher freight rates, import equivalents on manganese and chrome ores were higher. Indian manganese, 46 to 48% Mn, settled at $1.05 to $1.10 per long ton unit, c.i.f.

(*Continued on page 122*)

Major Metals

U. S. DAILY AND AVERAGE PRICES

March 1951	Electrolytic Copper (a) Domestic	Electrolytic Copper (b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
1	24.200	24.425	181.500	17.000	16.800	17.500
2	24.200	24.425	181.750	17.000	16.800	17.500
3	No Market	24.425	181.750	17.000	16.800	17.500
5	24.200	24.425	179.500	17.000	16.800	17.500
6	24.200	24.425	174.500	17.000	16.800	17.500
7	24.200	24.425	162.000	17.000	16.800	17.500
8	24.200	24.425	139.000	17.000	16.800	17.500
9	24.200	24.425	134.000	17.000	16.800	17.500
10	No Market	24.425	134.000	17.000	16.800	17.500
12	24.200	24.425	No Market	17.000	16.800	17.500
13	24.200	24.425	134.000	17.000	16.800	17.500
14	24.200	24.425	134.000	17.000	16.800	17.500
15	24.200	24.425	134.000	17.000	16.800	17.500
16	24.200	24.425	134.000	17.000	16.800	17.500
17	No Market	24.425	134.000	17.000	16.800	17.500
19	24.200	24.425	134.000	17.000	16.800	17.500
20	24.200	24.425	134.000	17.000	16.800	17.500
21	24.200	24.425	134.000	17.000	16.800	17.500
22	24.200	24.425	134.000	17.000	16.800	17.500
23	24.200	24.425	134.000	17.000	16.800	17.500
24	No Market	24.425	134.000	17.000	16.800	17.500
26	24.200	24.425	134.000	17.000	16.800	17.500
27	24.200	24.425	134.000	17.000	16.800	17.500
28	24.200	24.425	134.000	17.000	16.800	17.500
29	24.200	24.425	146.000	17.000	16.800	17.500
30	24.200	24.425	150.500	17.000	16.800	17.500
31	No Market	24.425	150.500	17.000	16.800	17.500
AVERAGES FOR MONTH						
March	24.200	24.425	145.808	17.000	16.800	17.500
AVERAGES FOR WEEK						
March						
7	24.200	24.425	176.833	17.000	16.800	17.500
14	24.200	24.425	135.000	17.000	16.800	17.500
21	24.200	24.425	134.000	17.000	16.800	17.500
28	24.200	24.425	134.000	17.000	16.800	17.500
CALENDAR WEEK AVERAGES						
March						
3	24.200	24.425	182.042	17.000	16.800	17.500
10	24.200	24.425	153.833	17.000	16.800	17.500
17	24.200	24.425	134.000	17.000	16.800	17.500
24	24.200	24.425	134.000	17.000	16.800	17.500
31	24.200	24.425	141.500	17.000	16.800	17.500

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

March 1951	Sterling Exchange "Checks"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
1	280.000	90.160	78.500d.	248s.	$35.00
2	280.000	90.160	78.500d.	248s.	35.00
3	(e)	(e)	(e)	(e)	35.00
5	280.000	90.160	78.500d.	248s.	35.00
6	280.000	90.160	78.500d.	248s.	35.00
7	280.000	90.160	78.500d.	248s.	35.00
8	280.000	90.160	78.500d.	248s.	35.00
9	280.000	90.160	78.500d.	248s.	35.00
10	(e)	(e)	(e)	(e)	35.00
12	280.000	90.160	78.500d.	248s.	35.00
13	280.000	90.160	78.500d.	248s.	35.00
14	280.000	90.160	78.500d.	248s.	35.00
15	280.000	90.160	78.500d.	248s.	35.00
16	280.000	90.160	78.500d.	248s.	35.00
17	(e)	(e)	(e)	(e)	35.00
19	280.000	90.160	78.500d.	248s.	35.00
20	280.000	90.160	78.500d.	248s.	35.00
21	280.000	90.160	78.500d.	248s.	35.00
22	280.000	90.160	78.500d.	248s.	35.00
23	280.000	90.160	Holiday	Holiday	35.00
24	(e)	(e)	(e)	(e)	35.00
26	280.000	90.160	Holiday	Holiday	35.00
27	280.000	90.160	78.500d.	248s.	35.00
28	280.000	90.160	78.500d.	248s.	35.00
29	280.000	90.160	78.500d.	248s.	35.00
30	280.000	90.160	78.500d.	248s.	35.00
31	(e)	(e)	(e)	(e)	35.00
AVERAGES FOR MONTH					
March	280.000	90.160	78.500d.	—	35.00
AVERAGES FOR WEEK					
March					
7	280.000	90.160	—	—	—
14	280.000	90.160	—	—	—
21	280.000	90.160	—	—	—
28	280.000	90.160	—	—	—

Calendar week averages, New York Silver: March 3rd, 90.160; 10th 90.160; 17th, 90.160; 24th, 90.160; 31st, 90.160.

(e) No Market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound.

Quotations for zinc are for Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West, effective Jan. 1, 1951, commanded a premium of 1.35c. per pound over the current market for Prime Western; Special High Grade 1.50c.

Quotations for lead are for domestic common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and fraction of a cent fractions per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance for carrying, delivering and marketing. In addition to foregn silver, the quotations also apply to domestic and Treasury silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver is 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U.S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Behind the By-Lines . . .

G. P. Luljon

» **"One of the most important stories** E&MJ has ever brought you" is the way we would tag this month's 32-page special report on better management. We asked the Hollinger people to write the article for E&MJ to pass on to mine management everywhere, after we saw what they were accomplishing at their mine in the Canadian North Country.

Dollars and cents benefits from the Hollinger program of progressive management are plainly evident. These alone would make the article well worth your reading. But one point even more significant to us is morale. We have never been at a mine where from miner to manager, there was a higher level of morale. It has been an important factor in increasing productivity at this famed old gold mine despite ever deepening and more complex mining. (Just how deep and complex is evinced by almost 300 miles of track underground.)

The excellence of the job being done by Hollinger was brought home to us in a talk with Joe Disley, Asst. Mine Superintendent. Mr. Disley has been supervising men since his army days in 1917. His comment on the program was, "I have learned more about handling men in the last five years than I did in the previous 29."

That did it! When an experienced mining man made a statement like that, we knew we had a story.

» **The Mining-Looks-to-the-Future Division** (See E&MJ, July, 1949) has a stimulating report for you this month. A look at the mining companies' annual reports which are now coming in, reveals that the industry as a whole has more plans than a sailor on shore leave. A summary of the more important developments can be found on page 125.

» **Perhaps you noted a slight delay** in the arrival of your March issue of E&MJ. Before you chalk this up to the vagaries of the editors, let us hasten to inform you that the trouble lies in the awkward process of changing printers; from Chicago to Philadelphia. Apparently liaison work between the two shops leaves something to be desired. Either that or communications between here and Philly are routed through lower Mesopotamia. We hope to have this straightened out come next Michaelmas. —By the way, when did you get your April issue?

» **One significant point in** the following paragraph from a Lone Star Steel Co. news release is the fact it constitutes an admission in black and white that somewhere, somehow there is something in another state that is bigger than its Texan counterpart. But those Texans don't give up easily.

"Predicting the day when Texas would be the home of an iron and steel industry that will rival Birmingham, and might even approach Pittsburgh, E. B. Germany, president of Lone Star Steel Co., said Saturday his firm would assist in any way possible the construction of additional iron and steel plants in East Texas."

» **Having trouble picking out** a birthday present for a friend? Here are a couple of suggestions we're not using this season.

How about an old Japanese destroyer? Office of Naval Material is soliciting bids from private companies to salvage 400,000 tons of scrap metal from beached or sunk Japanese ships at Palau, Saipan and Truk. Included are the Nip cruisers Agano, Naka, Yubari and Katori, 5 destroyers and 13 subs. Just the thing for your yachting friends.

Our alternate suggestion is a 50-page list of names and addresses of individuals in Pawtucket, R.I. It is currently languishing in McGraw-Hill's Service Dept. if you're interested. Nobody else seems to be.

» **If there is such a thing,** we are undoubtedly members of the "Rock of the Month Club." (If there isn't such a thing, we will be glad to turn the idea over to any mineral purveyor at a reasonable fee.) Last month, you may recall our bit about the arrival of a mysterious piece of Congo sandstone. This month's selection is a scintillating hunk of galena, about half as big and twice as heavy, from the Yukon. Its an excellent specimen. We appreciate it; but who sent it?

» **He was going home and it was dark.** His road from the station was a lonely one and he was hurrying along as fast as he could when he realized suddenly that a man behind was following him purposely. The faster he walked, the faster the man followed until they came to a cemetery.

"Now", he said to himself, "I'll find out if he's really after me," and entered the cemetery. The man followed him. He circled a grave and the pursuer dodged after him. He crawled under a hedge. Still the man was after him. At last, almost in desperation, he turned and faced the fellow. "What do you want? What are you following me for?

"Well, sir, its like this. I'm going to Mr. Brown's house and the station agent told me to follow you because Mr. Brown lived next door—Tell me something. Do you always go home like this?

This fable came to you through the courtesy of The Heil Co.'s **Sales Booster.**

"It's my own strapless creation."

Better Mining Through Better Management

Here's the box score for a company that believes in it:

- **One and a quarter million dollars saved in labor in 1950**
- **Absenteeism down from 10.5% to 4.3%**
- **Labor turnover cut from 55% to 22% of the total payroll**
- **Accident frequency cut almost in half**

The significance of these facts is tremendous!

To Hollinger Consolidated Gold Mines they have probably meant the difference between extinction and continued profitable operation.

To you, they are concrete evidence that there is something that you can do to keep your mine from being bogged down by low productivity and lack of manpower. For not only has Hollinger raised the miner's productivity and reduced costs but in so doing, labor turnover and absenteeism have been drastically curtailed. Think what this means when your mine's production may soon depend on whether you can keep men on the job.

To alert managers, the facts are proof that the philosophy and techniques of progressive management can be applied to mining. Hollinger's achievements are a forceful answer to the reactionaries' obstinate stand that "these modern management stunts may work in other industries, but they won't work in mining."

The handwriting is on the wall for the buy-a-bigger-whip school of management. But make no mistake. Coddling the worker is not the answer either. Enlightened management treads a sound path between, and we have asked Hollinger, because of their obvious success, to point out a few of the guide posts.

Hollinger faced a dismal economic situation at the close of the war. Trapped between the fixed price for gold and rising labor and material costs, plus ever deeper and more complex mining, the question had become, "Can we stay in business?"

Revision of management policy was the answer. This meant a Herculean task in education and retraining of supervisors, and more members for the management team.

There may have been other ways to get out of the squeeze, but see how this one worked. On the basis of 1943 standards of efficiency, labor costs in 1950 would have been $6.15 per ton, plus an additional 16c. resulting from narrower veins now worked and increased handling of ore in internal shafts. Actual labor cost in 1950 was $5.12 per ton, a saving of $1.19 per ton, or a total of about $1,265,000 saved. Higher morale, fewer accidents, less labor strife went hand in hand with this increased efficiency.

These benefits can be yours for only your sincere, active cooperation. Hollinger has supplied the blueprint, necessarily based on sound management principles, but a program like this will never succeed without top management's enthusiastic support.

But this is Hollinger's story. Let them tell it.

The Man and the Idea Behind the Program

The Key to Production

"I believe that the improved welfare of industry and the individual lies in increased production"

KNOWING THAT THE BEST RESULTS can be obtained only with the fullest cooperation of the workmen no matter how perfect the equipment may be; realizing that all the knowledge concerning a particular enterprise is not confined to any one person nor to any one level of management; believing that the majority of Hollinger employees were reasonable persons and that they could and would assist in finding the solution to our problems if the situation were more fully explained to them, and if they were shown that increased production was just as necessary to their security as to the owners; we decided to make a wholehearted attempt to coordinate and integrate the knowledge and activities of all of us.

I believe that four statements of Richard S. Reynolds, Jr., president of Reynolds Metals, made at the Production Conference in Chicago last December, express very clearly the philosophy upon which the Hollinger program has been based.

1. The key to production is people.

2. The most important single individual in this striving for enlarged production is the foreman.

3. There should be increased communication between the foreman and his senior supervisor.

4. It is through the leadership of the supervisors that the belief can be transmitted that increased security results from increased productivity.

In other words it is just as necessary for top management to know what the employees are thinking as it is for the workman to understand what is required of him and the reasons for decisions which affect him.

This practice is nothing more than an extension of the same relationship that regularly exists between the president and the general manager. In operational affairs the president takes into consideration the facts and recommendations of his manager in order to arrive at a decision. It apears to me that management has too often failed to recognize the advantages of the same procedure for application down the line. Carried to its logical conclusion it means that information and suggestions from the lowest levels will be taken into consideration in making management decisions. Only by such a procedure can there be the development of complete responsibility and with it a corresponding vitality of authority.

To the workmen, the interpreter of company policy is his supervisor, hence it is important that the supervisor understand the basis upon which decisions are made. Having participated in making decisions, he can with conviction transmit them to the workmen.

When the president informed me of the directors' decision regarding my appointment as manager, he remarked that Hollinger operations called for the best in ability and proficiency from all who by training, experience, and association were qualified to be of assistance. The significance of this comment was forcibly impressed on me while addressing a group of supervisors during a Victory Loan Campaign in 1944. During the short discussion that followed, I was struck with the realization of how little I knew of the

Where to Look for the Facts

On Production	Production Engineering Department—Cost-Cutting Task Force	74
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is People

E. L. LONGMORE
General Manager
Hollinger Consolidated Gold Mines Ltd.

thinking and of the problems of these men, and also how little they knew of what I thought and of the problems of management. Thereafter, how to make the best use of the accumulated knowledge and experience within the organization became my immediate problem. To assist in bridging this gap, our Industrial Relations Division was established.

Using as a guide information in the writings of competent authorities we charted a course which we felt best met our conditions. We availed ourselves of the valuable advice and assistance of Stevenson & Kellogg, management consultants for the more important phases of our program, but at all times the final decision as to what should or should not be done was made by line management. This is no reflection upon the service of our consultants, but the conviction was held that if management were incapable of deciding what was to be done, it would be incapable of carrying out a program outlined by an outside agency.

This procedure may appear unnecessarily slow but in the end the effect was most desirable. Not making any move before it had the endorsement of the majority of those who would be responsible for results, assured a thorough examination of the proposal before it was adopted.

The necessary training courses and discussion groups in which every member of supervision has participated, have been most productive. Not only is there better understanding of our problems, but qualities of leadership and potentials of capacity of many individuals have been disclosed. At the same time each supervisor has gained a better understanding of his duties and the personal qualities necessary to properly discharge those duties. In a few cases such disclosures have resulted in demotions, but fuller appreciation of the necessary qualities and abilities has reduced the unfavorable criticism and resentment over such changes and has led to a strengthening of the organizational personnel.

In conclusion I wish to say that it is my firm conviction that a sound human relationship policy is just as essential for high efficiency as for the personal satisfactions of all concerned. Such relationship can come only from an understanding of each other's needs, problems and aspirations and the recognition of the fundamental, economic fact that a high standard of living can be maintained only by efficient operation. Further, a lessening of tensions and conflicts in industrial life can only come from this fuller understanding.

What is being attempted cannot be a short term policy. The gourd that grew in a night, perished in a night. The oak which takes years to mature endures.

I wish to say that unless there is integrity of purpose, a willingness to be fair and reasonable, a willingness to evaluate impartially the constructive critism of subordinates before making a decision, and philosophical contentment to make haste slowly—I would hesitate to embark on any program which depends so heavily for its success upon the uniform cooperation of the staff.

E. L. Longmore

on Hollinger's Management Methods

On Employee Training
Trained Young Engineers—Your Soundest Investment 94
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On Safety
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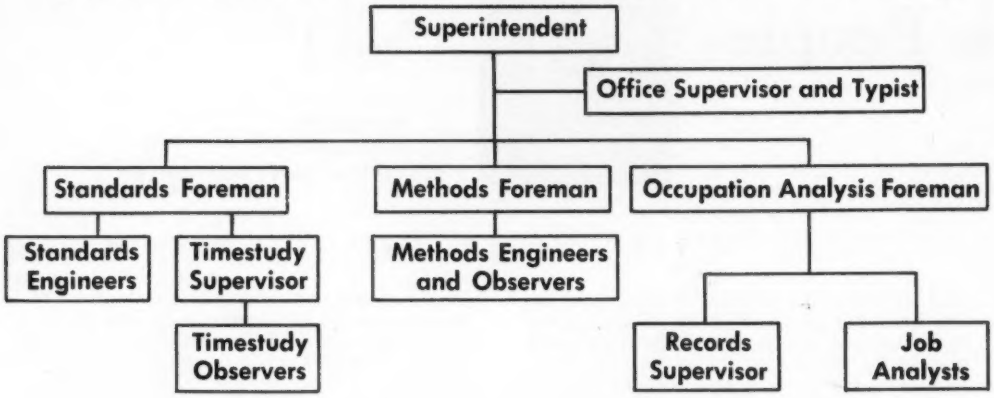
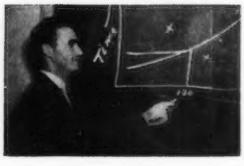
How the Production Engineering Department is Set Up



Production Engineering—Cost-Cutting Task Force

Here is the blueprint of a top-notch Production Engineering Department; a team designed for systematic assault on rising mining costs.



J. W. THOMSON
Superintendent
Production Engineering
Department

WITH A FIXED PRICE for its product, and cost of labor and material rising following World War II, the management of Hollinger was—and still is—faced with only one avenue of escape from a price-cost squeeze. That avenue is one of continuing attack on costs by increasing the efficiency—more effective use of material, equipment, labor time and management time. When the need for a special group for investigation and research along these lines became evident, the Production Engineering Department (PED) was established.

PED's function is to aid other mine departments in the performance of their work. Hence, investigation, measurement, and recommendation for action make up the core of PED's work. No direct authority or responsibility for action in the line organization is held by any one in the department. Its people have the implied "authority of ideas" and not of command. So also have they an implied responsibility for effectiveness of the work of any section they had been required to help.

Specifically PED carries on control work, installs and instructs in new work methods, explains contract rates to miners, guides new reporting systems, and administers the base wage rate structure. The producing department remains fully responsible for whatever is done in its working area. This is continually being emphasized, so that those line supervisors who are actually responsible for production will retain control over their work and will not accept a proposal for action from "the experts" without a thorough examination of its possible effects.

Behind the division of work between staff and line departments, there must exist a personal confidence between the staff man and the production men whom he helps. For this reason, most of the PED's personnel have been producing men and all are expressly given instructions to "live with the job" so that the all-important personal contacts will develop mutual confidence. No one in the department has been taken directly from outside the property, even at the time it was started. The only use of outside services came when a firm of management engineers conducted training in time study.

Fact-finding is PED's business, but the importance of the facts is zero until they are analyzed, correlated and some significant conclusions reached. Then we still have to use the conclusion to change existing conditions. Because many men tend to resent change, those men the change will

affect are encouraged to participate as early in the process as possible. In this way, results of the department's work are made more palatable and its proposals more readily put into effect.

How PED Functions

The department consists of three operating sections and an office and typing service. The organizational set-up is shown opposite.

The Standards Section supplies the work measurement function, establishing all time standards for the various incentive plans. Administration of the plans is also worked out by this section, along with the line supervisors concerned. Examination of work performance, from a labor earnings standpoint and a management cost standpoint, is an added function of the Section. While past performance was the basis of many work standards formerly in effect, nearly all standards now being used have a measured timestudy basis. We are using time standards increasingly to estimate costs in the choice of work method or equipment. Standards engineers are assigned to various working areas underground, corresponding to a mine captain's area. A smaller group of observers collects time and other data for the compilation of production standards on general underground and surface work.

The Methods Section, although separate from Standards, works very closely with it. The ideal of setting a standard method before a time standard or piece-rate is put into effect, is not always realized. But experience shows that the less definite the method, equipment and conditions, the more unfair will be any wage incentive plan. Hence, every effort is made to back up even old-fashioned piece rates by some statement of conditions when they are to apply. Where incentives are desired, but not yet in effect, the Methods Section will analyze the work for possible improvement, encouraging the line supervisor to take a leading part. Work layout, and material used will also come under inspection. Even organizational changes are not overlooked. The motivating force is not always desire for an incentive plan. As the supervisory group becomes increasingly "cost conscious," more methods will be overhauled.

Experimental work on rock drilling equipment is part of the Methods Section duties.

Only recently has the Occupation Analysis Section become fully operative. For four years, the function was one of research into Job Evaluation, aiding in wage administration, and making analytical studies of parts of the mine's organization. Recently, it became evident that the company's wage structure required modernizing, especially in matching base wages to job content. The arrival of labor unions as the employees' representatives and the pressures of living costs making wage raises necessary, have given the company opportunity to correct wage rate unfairness. Other benefits—in cost and morale—are expected from the full fledged operation. Job analysts have recently been trained to work with the evaluation program.

A closely related subsidiary function, located here because of its necessary relationship to work division and organization, is that of mine reporting investigation. Here again, much of the work to date has been of research type, looking to future adoption of improved costing techniques and more meaningful production data. Some preliminary excision of useless paperwork and re-arrangement of reporting has already been done, however.

How to Win Cooperation

In all assignments participation by the producing departments is continually stressed, especially during development and try-out stages. Talks and plans at department head level may originate either from top management or from an operating need. Detailed plans are made, information gathered and reviewed by those closer to the work. Discussions take place between mine captains or shop foremen and PED men. Other staff services are called in when needed, such as Survey, Cost, or Purchase and Stores Departments. Then, before any try-out involving the working force, an adequate explanation is made to those affected either by talks with them or by notice board and magazine information channels. Often both talking and written explanations are made, with plenty of opportunity provided for questions and answers.

In the introduction of new rates the direct supervisor—shift boss foreman—is the key man, and the one looked to by his men for explanation. Many details undergo questioning, and if the shift boss has not a specific answer, he knows that he can call on "the expert" for help. But by knowing the basic thinking behind any plan, he is well equipped to handle most discussions with his own men. Then, too, many faults in a well-laid program have been picked out by wide-awake shift bosses, before the die is cast. For these reasons, all first-line supervision are "in the know" well in advance of a planned change, when possible. When this has *not* been done, the change invariably has not had the desired effect.

Who's PED Material?

In staffing the department, each man is appraised as to his abilities in doing investigation work, making satisfactory contacts, and exercising initiative in work assignments. Timestudy training, even for those not destined for Standards Section work, is regarded as necessary grounding. Following this first stage training, men are changed from one section to another as much as stability and good quality work will allow.

PED work has been found remarkably good in preparing men for staff or supervisory positions in other departments. To further this preparation internal conference and discussion sessions are held. The department's techniques and policies are reviewed, company actions and programs are explained.

Contact with general industrial thinking is maintained through membership in groups such as the American Management Association and the Society for the Advancement of Management. Department members are sent periodically to conferences and seminars sponsored by these and other institutions. Since community activities afford a training area for "leadership" many of the staff participate in service clubs, evening classes and similar groups.

The guiding principle behind all Production Engineering Work is to bend every effort towards making it easier and cheaper to produce the wealth that is to be distributed. Certainly, the atmosphere in which the wealth is produced must be cleared with the confidence that no one group will gain at the extreme expense of any other group. That confidence as it exists at Hollinger, has permitted the productive departments and their staff services to cooperate toward the common objective of more production at less cost.

How Systematic Study of

● Big mine or small mine, here are some ideas you can apply today for quick results in lower costs and increased productivity

M. R. DAVEY
Methods Foreman

WORK OF THE METHODS SECTION has been concerned with two main tasks — "Standardization" and "Methods Improvement." The two are closely linked and have been carried out simultaneously in our work, with possibly a slight edge in emphasis on Standardization. The ideal sequence of events is to develop the best method of performing a job, record the method, apply it, and use it on all similar jobs until a better method is worked out. However, in starting a general program of this type, it will usually be found that the Standard Methods — the records of what is presently being done—are not too well defined. This was the case at Hollinger.

We felt that considerable savings could be made in a comparatively short time by describing and using the best method as presently used by the best crews. In the course of carrying out this work, improvements to the best methods in use were made. These were incorporated in Standard Methods write-ups. For clarity and ease in description, however, the two are treated separately here.

Standardize Methods for Better Mining

JOB STANDARDIZATION has been defined as "determining the one best way of performing a job using the means at hand, recording the exact method, and establishing means to maintain the standard conditions." There are many reasons why standardization was thought desirable A few are given below.

1. Doing work the one best way means doing it in the most economical way. Hence it is good business to have everyone, working on similar jobs, using the best method.

2. In order to improve a work method we must know how the job is presently being done. How else can we say that the new idea isn't already being used? A written standard method gives this information readily.

3. Standard methods are practically a "must" for incentive rate setting. With written procedures, the planning can be more positive and hence the rate can be set more equitably.

4. One very important use is in training or re-training workmen. If there are standard procedures to follow, miners in general should become more skilled—the "poorer" miners will be using the methods of the better ones. An example of this may be shown from our standardization experience. It was noted that maximum break from stoper drilling results when the angle of hole is about 60 deg. from the horizontal. It was also noted that not all miners were using this. Some have since been re-trained with a resultant increase in the number of tons broken per hole. New miners are taught to follow this method.

5. Standardization of material and equipment is important in keeping costs down. It cuts down on inventory, delivery costs, waste — through ordering proper amounts and proper sizes, etc.

6. Cost estimates can be more reliable if there is assurance that a certain method will be used.

7. A supervisor's time is spent largely in planning operations. The more of these that can be standardized, the more the supervisor will be free to plan the operations which cannot be standardized. More planning should result in lower cost.

We realized that the application of the detail of standardization to mining is difficult. Often the width of vein varies; the structure and hardness of the rock is inconsistent; repairs called for in the surface shops are many and varied; and so on. However, it was felt at Hollinger, since some standardization was already being carried out (one type of stoping; one kind of blasting powder in stopes; regular cage travel times; etc.) and more was desirable if possible, an attempt should be made to increase the number of standard procedures. As an example, some highlights of a typical project are given below.

Stope Standardization

The above principles were discussed by the Methods section with a committee of three second and third line supervisors controlling about one-sixth of the stopes in the mine. It was decided to have a try at standardizing at least some of the stoping operations. The Methods men observed several of the best crews in the mine, noted and

Methods Will Cut Costs

collected factual information on their methods and presented this to the committee of line supervisors to make the decision as to the method to be adopted. The primary emphasis was on drilling patterns, although general methods were noted for other parts of the stoping cycle.

The next step was to apply the standard methods to a stope where the performance was below average. This first entailed indoctrinating the first line supervisors and the work crews concerned. Crews were guaranteed a fair minimum incentive, to ensure their cooperation. The standard methods were applied by having the Methods man in the stope continually, and working in cooperation with the shift boss and miners. Relations were excellent and crew incentive earnings exceeded the amount guaranteed. Application in a second stope gave similar results.

From this encouraging start, similar committees were set up for more captains' beats bringing representatives from half the mine into the picture. Principles were explained to the new committees along with the methods set by the first committee. These same standards were applied in four more stopes and again results showed increases in production.

At this point, the progress was summed up by the three committees, the Production Supervisor and the Methods Section. The methods, written to that time, were revised and considerably expanded—possible in the light of all the testing done.

More recently, application is being made to some stopes from the rest of the mine. The program is at the stage now where supervisors and crews are suggesting improvements and requesting that more standard methods be written—a healthy situation.

Future plans call for a general summation of the work and some means of imparting to all supervisors (particularly shift bosses) the progress, results, aims and method of application of the complete standardization program.

Other Standardization

Standard methods are being written for other underground operations—blasting raise rounds; drilling drift rounds; hanging air cylinders for dumping cars; to mention a few. It is planned to continue this practice as time permits.

Much has also been done in the surface repair shops in the way of compiling time and methods information. Here it is planned to use the standard methods for training, incentives, planning, etc., as previously mentioned.

Improve Methods Through Analysis

IMPROVEMENT IN WORK METHODS is being brought about by an analysis of methods. Methods analysis has been defined as "the examination of each operation of a given piece of work to eliminate every unnecessary operation and to obtain a more efficient method of performing each necessary operation. It includes the standardization of equipment, methods and working conditions; and finally it aids in training the operator to follow the standard method."

It can be seen that the above definition is similar to the one for job standardization—an addition being the elimination of unnecessary operations and the more efficient performance of necessary ones. It can also be seen that if work is studied with standardization as the intention, it is inevitable that improvements, to even the best present methods, will be suggested. This happened frequently during our program. Ideas for improvements came from the miners, supervisors and methods men. Since the Methods Section had the time and training, and could arrange the facilities for testing we became involved in assessing the value of most new ideas.

The basis of our methods training is that generally advocated in other industries today:

STEP I—Break down the job into its basic elements.

STEP II—Question every detail.

STEP III—Develop the new method.

STEP IV — Apply the new method.

These steps are believed fundamental to the improvement of any job and whether they are covered mentally, written, or by some more extensive means, will result in improvement in many cases.

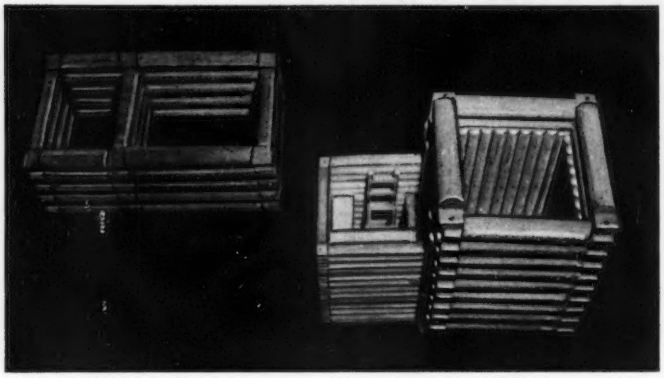
The breaking down of the job is important in order to get a good picture of what is actually happening. The ideal breakdown is concise and yet complete. Many types of charts have been developed, the ASME having standardized a charting procedure.

Questioning every detail is probably the most important part of the analysis. All the improvements we enjoy have been brought about by someone questioning what was presently being done. There have been many lists of questions published—designed to uncover inefficiencies in all type of jobs. The simplest list is: **Why? . . . What? . . . Where? . . . When? . . . Who? . . . How?**

The development of the new method will result from the answers to the questions if another method is practicable. This may involve the testing of new equipment (discussed later), trying a new sequence of operations, etc. In any event it involves contact with workmen, who are often a good source of sound ideas, so should be asked to help in the methods development. There is generally resistance to change and if the workmen have been consulted about the change, the application of the new method will be much easier. When applied, assurance should be made that the method is understood, and used, until a better one turns up.

Cited below are some examples of improvements made at Hollinger and how the foregoing type of reasoning has helped bring these about (Hollinger supervisors have received Job Methods Training and many of the ideas came from them).

CASE HISTORY — MILLHOLE INVESTIGATION



NEW MILLHOLE (right) saves $35,000 a year in stopes.

UNTIL RECENTLY, our millholes (for cut and fill stopes) were constructed with 7-in. minimum top diameter, round cribbing, suitably dapped and cut, 5 pieces to a round, with the rounds piled and nailed one on top of the other until the desired height was reached. The caps were cut approximately half way through the timber and one round raised the millhole about 9 in. The 5-piece round consisted of 2—12-ft. pieces parallel to each other and the stope, with 2—7 ft. 6 in. pieces perpendicular to these at their ends. The fifth piece—7 ft. 6 in.—was placed on the long members, parallel to the short ones to form two compartments—one for the manway and one for muck. The muck compartment was lined with 3-in. fir planks nailed on vertically at right angles to the cribbing.

An investigation of this method was originally touched off by one supervisor wondering if a length of cribbing shorter than 12 ft. could be used so as to avoid having to stand these pieces on end in the cage to transport them underground. Other questions arose and it was decided to have the Methods Section make a breakdown of the whole job — dapping, treating, transporting on surface and underground, to raising in the stope. All the points of the breakdown were questioned—"Can less material be used?"—"Can a less expensive material be used?"—"Can transportation be simplified?"—and so on.

As a result a new type of millhole has been developed. Daps are to be cut with suitable power tools; the longest piece of material is 8 ft. so that all millhole timber can be sent underground in the cages on trucks; the manway compartment is built of 5-in. round material alongside of and nailed to cleats on the muck compartment; daps on both the manway and muck compartments are cut so the horn thickness is uniform and gives a constant lift per round—simplifying ordering of material; 12 in. per round of muck compartment are gained in place of 9 in. previously (the space between cribbing is not serious as the inside lining keeps out sand fill). Also the inside area of the muck compartment has been reduced—thus requiring less material without having noticeably affected the flow of muck; and the millhole is now lined with 4-in. round lagging (local timber) which is cheaper than the fir plank.

Some millholes of this type have been in use for almost a year now and performance is satisfactory. The whole mine is gradually changing to the new type as stocks of the old diminish. A substantial yearly saving will be made by:

—using less material
—using less expensive material
—facilitating transportation
—mechanizing cribbing cutting

CASE HISTORY — CABLE ROLLERS

IT WAS NOTED during regular studies of stopes that scraper cable wear on walls and back was sometimes excessive. As a remedy for this, rollers have been devised—one type to prevent the cable rubbing on the timber, and the other to keep cable clear of the walls.

The overhead roller consists of a 3-ft. long, 2-in. round bar mounted in sealed ball bearings at either end. Our regular rock bolts (used to hold sheave blocks for scraping) are welded to either bearing. Then if the cable rubs on rock, holes are drilled and rock bolts on the roller are inserted and held in with our regular steel wedge. (There is axial movement of the bearings to reduce accuracy required in drilling the rock bolt holes.) Should the cable rub on timber, the roller can be put on and nailed through holes drilled earlier in the rock bolts.

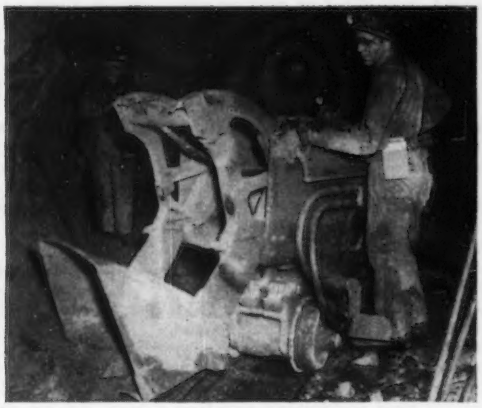
The wall roller, to prevent wall-rubbing, is made from a 4-ft. long, 3-in. pipe, again with sealed bearings at both ends. To each bearing is welded a semicircular steel strap with holes drilled for lag screws. This assembly is mounted on a solid post installed close to the wall where the rubbing occurs. A "fence," of 4-in. flat lagging, is built from this to the wall on both sides, leaving about 1 in. of roller exposed for the cable to run on.

The overhead rollers have proved satisfactory in reducing cable wear and the cutting of timber, while the wall rollers reduce cable wear as well as reduce the double scraping in some places. One roller will change the direction of pull approximately 15 degrees without seriously slowing the hoist.

CASE HISTORY — FUSE WINDER

RECENTLY A STUDY of the underground fuse capping house was conducted to assist in layout of a proposed new surface fuse building. During the study it was noted that the operator spent over 3 minutes holding and guiding the fuse as it wound in a single layer on the projecting arms of a rotating wheel. A winder was designed employing a discarded leyner machine feed screw assembly driven from the main cutter wheel shaft. A tension brake holds the fuse securely. Winding is now automatic, freeing the operator for other work.

IN THE CLASSROOM, trainees learn techniques of timestudy, effort rating on simple operations.



ON THE JOB, timestudy men obtain the basic data for formulating Hollinger's incentive plan.

Timestudy--A Tool for Management

T. J. HARKNESS
Research Foreman

HOLLINGER'S INCENTIVE SYSTEM is based on timestudies. Where do you get the men to make the studies? Hollinger gets them from the mine and trains them to do a fast, accurate job.

Training courses are conducted whenever timestudy men are needed. Applicants having at least one year of underground experience and one year high school, are screened by mathematical and aptitude tests. Selected trainees are placed in the timestudy classes.

Timestudy is introduced to the class with the following definition, taken from the company's Timestudy Manual:

"A timestudy is a complete, exact record of all of the work required to perform an operation, the actual time taken, the effort expended and all circumstances and conditions relating to the work. This includes the regular work elements together with such expected or unexpected delays which may occur throughout the study."

To clear up the reference is that phrase referring to effort.

Effort rating is defined as, "the process by which the timestudy observer compares his concept of standard pace or tempo of movement with the pace and tempo of the operator's movements."

Effort rating is a visual process of matching what is seen with what has been seen. "What has been seen" is an adjustable mental yardstick (adjustable to a variety of work, according to the observer's experience) built up from formal rating training and from experience. Mental images are formed of what standard pace—tempo of movement—looks like while different types of work are being done. The mental image of standard will be different for each type of work.

Formation of a wide variety of mental images requires effort rating training as an "anchor point." Because only a small portion of the total jobs observed can be used as training tests, the observer must form some images of given effort on all the work he observes. These he forms while timing and rating work under observation, often as "flash images," if he uses a fine element breakdown. Against these images, he matches the effort he sees, and notes down the comparison as an effort rating.

Standard effort rating tests at Hollinger include:

1. Walking over a measured distance of level unobstructed ground. Standard pace is three miles per hour.

2. Dealing 26 playing cards into four piles located on the corners of a twelve inch square. The cards are held six inches from the table top and dealt clockwise. The standard time to perform this test is one-quarter minute.

Trainees practice rating every day; the entire department three times a week. Each man is required to be able to rate these tests with a minimum accuracy of 90% and not more than 1% deviation.

Stop watch, study board and study sheets are next for trainees. Three methods of timing with the decimal minute stop watch (snapback, continuous, and cycle) are discussed. The standard study sheet is explained and detail that should appear is outlined.

1. Date, work place, name of crew and observer.

2. Operations studied, with start and finish times for each.

3. Element breakdown according to a standard breakpoint manual.

4. As many effort ratings as possible.

5. Estimated effort rating for entire operation.

6. Remarks pertaining to:

(a) Deviation from standard method.

(b) Amount, type, and condition of equipment and material used on the job.

(c) Service—effective and de-

layed, and effect on performance.

(d) Explain unusual occurrences.

(e) Production detail.

7. Diagrams—Every study is to have a diagram showing adequate detail and measurements covering all phases of the work operation studied.

To give trainees the "feel" of taking a timestudy, simple operations are performed in the lecture room with elements and their breakpoints decided beforehand. The first studies are only for practice in punching the watch. Later studies are rated. At each stage, there is time to clear up any questions that may arise. Card dealing is an example of the simple operations used in training our timestudy men.

1. Card dealing—the box is taken from the table and the cards (54) removed. The deck is shuffled once and 18 cards are dealt. The cards are shuffled twice and 18 cards are dealt. This is repeated. Then the cards are gathered up and replaced in the box.

Length of the initial studies increases as the trainees became adapted to taking them. Comparison between the elapsed time and recorded time is made to see that each trainee is reading the watch correctly. As studies become more accurate, a selected time for each element is obtained from the study using a frequency chart. These selected times are extended by the selected effort rating. A standard time is obtained for each element and then for the entire operation. These operational standards are compared among the trainees and within four days after starting the course, results will usually agree within 10%.

This training continues until results obtained by the trainee are satisfactory.

The second stage (except for daily practice in effort rating) consists entirely of timestudy taking and work up and analysis of these studies. All studies are taken in the company's bit sharpening shop where operations are repetitive and have manual time and machine time with only one operator. Length of elements in various operations ranges from .02 minutes to .55 minutes.

Procedure Is Important

1. Get permission of line supervisor to take the study.

2. Get operator's permission. Answer any question he may have about timestudy. (If he refuses permission, thank him and study someone else).

3. Observe work in cycle, determine elements and their breakpoints.

4. Record start time and take study.

5. Note all irregularities in work.

6. Record the finish time.

7. Complete remarks and drawings.

8. Write down any suggestions that the operator may have.

9. Show him completed study if he wishes.

10. Thank him for his assistance and cooperation.

While taking a study, the timestudy man will stand where the work can be seen but out of the operator's normal visual range and where he will not interfere with the operator.

Studies are worked up and a standard time is determined from each. These standards are compared with one another to check the accuracy of each man on the watch and consistency of the ratings.

When studies in the Bit shop have reached proficiency, a short course in Methods work is given so that they will be alert for methods improvement on any job. Trainees are also given a short talk on labor relations and safety.

Trainees are now ready to take studies underground. If the group is large, it is customary to use one stope as a training ground for the whole group for two to three weeks. This way trainees can study all phases of the work cycle. For a small group a workplace is found for each man each day.

Two days a week are now allotted to office work as the work-up and analysis of the timestudy are as important as taking the study. It also permits the instructor to review and criticize trainees' work and to clear up any difficulties.

Actual work-up of a study is a standard mathematical operation. An average time is obtained for each element, extended by the effort rating and then expressed in standard minutes. When the trainee can take studies and work them up with only occasional supervision, he is classified as a regular timestudy observer and transferred to the staff. This usually takes about three months.

Time Allowances

Training in other phases of the department's work is given as the need arises. When a new timestudy observer is very proficient, or completes a series of timestudies on a particular operation, he is assigned the analytical work with the following details:

1. Time distribution sheets—to find distribution of actual time for all productive and non-productive operations in a work cycle and to determine the occurrence factors for irregular and delay elements.

2. Comparison sheets—to record the standard time taken for each constant element in any operation and to aid in determining element standards.

3. Charts and graphs—for recording standard times for each variable element in any operation and to obtain a range of values for the controlling variable.

4. Allowances—

(a) Fatigue—A certain percentage is added to each element standard to compensate the operator for rest time. A man standing without load for the entire working day is considered to require a fatigue rate of 5%. All other elements (depending on their nature) are compared to this allowance and expressed in multiples of 5%.

(b) Personal allowance—A straight time allowance added to the standard so the operator may attend to personal needs.

(c) Enforced delay—An allowance in the standard for delays that cannot be separately recorded. Otherwise the operators (on incentive) are paid only their base wage.

(d) Lunch—A straight time allowance is given, if included in shift time.

(e) Travel time—As for lunch.

(f) Supervision—As for lunch.

(g) Machine allowance—All machine controlled elements are given a common 125% incentive factor unless work must be performed during the machine run time. In this case, standard time will be the standard time plus fatigue allowance for the work performed or the machine time extended by 125%, whichever is higher.

(h) Wait time—Where one man of a two-man crew has to wait while the other man works, an arbitrary rating of 115% is applied.

When all these steps have been followed, an operational standard has been determined. Once a timestudy man has practice in this analysis work, further standard determinations are largely routine.

SMALL MINES, particularly, will appreciate how revision and mechanization of reporting methods saved Hollinger several thousand dollars and 20,000 man hours per year and also reduced errors by 83% —And Hollinger is not stopping there—But let them tell how . . .

You Can Streamline Mine Reporting

H. J. MURRAY
Records Supervisor

SHORTLY AFTER THE INSTALLATION of the new Hollinger incentive plan in 1948, we found that our underground reporting system was inadequate in that it did not supply sufficient information to prove the success or failure of the plan. To correct this situation, the management decided that the whole system of underground reporting should be investigated, keeping in mind that a report, to justify its existence, must be a useful guide to supervisory action.

Investigation showed us that:

(a) Many department heads were receiving reports that were of no use to them.

(b) That the routing of some reports could be changed to improve efficiency.

(c) That nineteen reports could be cancelled out of a total of seventy-two.

(d) That fourteen reports could be revised.

(e) That an improved redivision of the work could be made.

The shift boss's sheet, for example, after all information had been recorded in the time office, was sent to the Cost Department for costing purposes and the pay ledger to the Pay Department for payroll purposes. To perform this work satisfactorily in the Underground Time Office required the services of nineteen clerks.

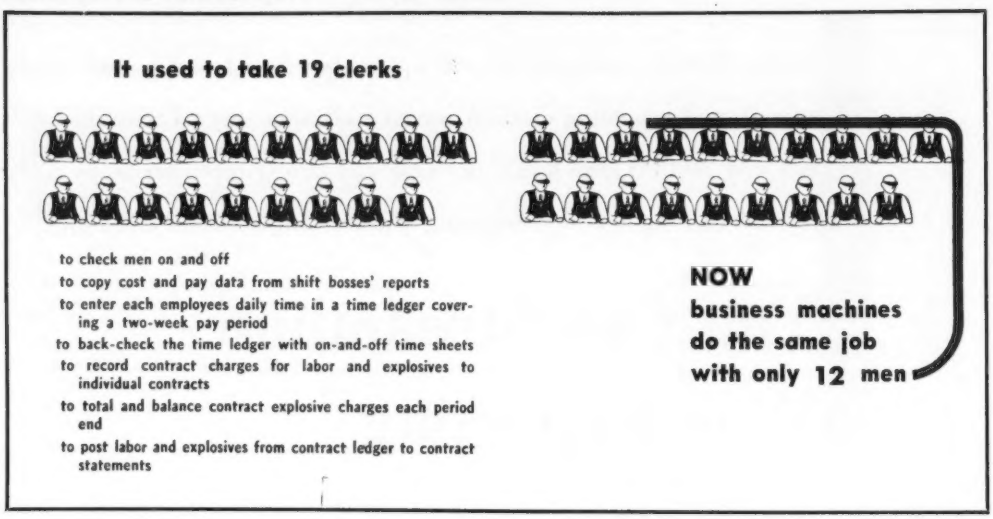
As a first step, we installed time clocks and a revised method of reporting and tabulation information by International Business Machines. In this instance it might be well to note that the job of checking men on and off by manual check sheets cost approximately $1,897 per annum for labor. By purchasing five clocks at a total cost of $1,825, we were able to eliminate this labor cost and replace it by an annual charge for depreciation of $261 as a write-off against the cost of the clocks. This in itself accounted for only a small portion of the total savings.

The time clock cards are now used to check men on and off the property and to record all absentee information that had been previously posted in five separate mine captains' books. The reasons for the absenteeism had been entered in these books and reposted to the pay ledger, this manual job of posting and reposting absentee information taking up considerable time. By having the information on the clock card each man was able to see his own absentee record.

Our present procedure for recording employees' daily time for cost and pay purposes is to send the original report, as made out by the shift boss, to the cost department where almost all the work formerly done by the time clerks is tabulated by I.B.M. directly from the report. Each period end (the Hollinger year has 13 periods) we have I.B.M. totals for all costs pertaining to contract labor and explosives. Special sheets are also put through I.B.M. for contract purposes each period end, the completed contract statement showing the total hours worked on contract, the total hours allowance and the grand total of all hours plus the charges for explosives. This is all machine work and the information is taken directly from the shift boss's daily report. Separate runs are made for work place costs, contracts, general mine costs, and captains' mine unit costs, etc. This sorting and resorting is all done by machine. A report is also tabulated by I.B.M. daily which shows the contract hours, allowance hours granted and the cost of explosives used. This report is posted in the mine dry for the contractors' inspection.

The period contract statements prepared in the Cost Department are sent to the Survey Department where they are attached to the measured work statement and returned to the Cost Department for the computation of incentive earnings. The cost statement and the measured work statement are made out in triplicate, one copy for the contractor, one copy for the mine captains' file and the original copy kept for cost and pay purposes, eventually being filed in the Survey Department.

A chart showing the delays and allowances for each section of the


It used to take 19 clerks
to check men on and off
to copy cost and pay data from shift bosses' reports
to enter each employees daily time in a time ledger covering a two-week pay period
to back-check the time ledger with on-and-off time sheets
to record contract charges for labor and explosives to individual contracts
to total and balance contract explosive charges each period end
to post labor and explosives from contract ledger to contract statements
NOW
business machines
do the same job
with only 12 men

mine is posted in the Production Supervisor's office. This provides him with some control in ensuring that delays and allowances do not become excessive.

It was not until February, 1950, that the completed time-keeping system was in full operation as it was necessary first to obtain agreement between the department heads that a change was desirable. This way, each department head knew what was going on and was familiar with the proposed changes before they reached top management.

A check of the new system showed a decrease of 83% in errors. This was to be expected, since it was a case of business machinery accuracy versus the accuracy of different individuals working under office conditions that varied from poor to good.

Through report revisions, cancellations, re-routing and a more effective division of the work, we were able to save approximately 20,000 man-hours per year, 75% of this saving being due entirely to a redivision of the work.

Future Plans to Measure Costs

The prime purpose of cost accounting is to supply the production group with complete information necessary to successful and efficient operation of their departments. These cost reports must show the expense dollar that the individual supervisor *alone* is responsible for, in addition to those he is partially responsible for.

To obtain such results at Hollinger, tentative plans are in preparation whereby the plant as a whole will be divided into cost centers or departments. By this method it is intended to relate all costs to the lowest level of supervision, without having charges crisscrossing from department to department. The only expense chargeable to a department or section (exclusive of overhead or burden) will be the company dollar which that department alone controls.

In addition to relating the expense dollar to the supervisor responsible, it is proposed to relate costs to a ton of ore produced in any given section of the mine. This data will help the operating group to forecast mining costs at different depths. The form of the report will be such that all unit costs will be shown on a single sheet in totals by departments and sections, for easy digestion. The operating group now finds it difficult to separate its expense dollar from the expense dollar of other departments. This, we hope to overcome by the use of a center cost system similar to the one described.

Keeping in mind that center cost procedures take considerable time to install, and that any changes made will affect all departments of the company, plans will be carefully checked by those concerned. It may mean a rearrangement of our inventory system, a change in recording depreciation for operating purposes, the setting up of control accounts, estimating the life of machinery on a new basis, a change in the method of distributing overhead and many other changes, especially in current operating reports.

As to timing, the principle guiding the plan is that cost accounting in industry relates specifically to production and for this reason alone cost reports should take precedence over other forms of reports. We are going on the assumption that the operators are the ones who spend the company's money in producing the product. Therefore, they should be advised of their expense items in advance of others. This is considered a necessary requirement if our costing methods are to serve a useful purpose.

If at some future date the company finds it desirable to institute departmental budgets, the necessary background of information will be available for this purpose.

Cooperation Needed

Cooperation between the accounting department and the operating group is essential if costing problems are to be solved successfully. The accounting people cannot, by themselves, install a system of costs without working in close cooperation with the production group.

This tentative plan of dividing the plant into cost centers, which we have under consideration at Hollinger is, as yet, in the early stages of development. Future progress of the plan will depend entirely on the cooperation of all department staffs. Without their approval and participation, the plan cannot be brought to a successful conclusion.

Table I. Why Hollinger Redesigned Its Incentive System

BEFORE

1. Original rates were based on an estimate of an average day's work of the average miner under average conditions existing at the time the rates were set.

2. Base wage rates had risen and incentive possibilities lost their meaning, related to the day's pay.

3. Physical conditions at the mine had changed making ore recovery more difficult. This was only partially offset by new type equipment and improved mining techniques.

In addition to the adverse effect of changing conditions, the fact that the rates were originally based on average conditions left miners subject to even greater inequities, caused by the extremely wide variations in mining conditions resulting in "good" and "bad" stopes, where earnings did not reflect the crew's skill and effort.

AFTER

1. Payment of incentive earning must be in proportion to the amount of work done in excess of a standard requirement set according to actual conditions.

2. As near as practicable, the same opportunity must be provided for earning incentive pay throughout all phases of an operation, when skill and effort requirements are similar.

3. Wage incentive rates must be established so that an average competent worker can earn 25-30% of his base wages in extra earnings, for a sustained output throughout the shift.

Complete application of these principles is necessarily tied in with the basic wage structure, the cost of accurately and consistently measuring a "fair day's work", the cost of administering incentive rates, and the almost unlimited variety of underground working conditions.

How to Design an Incentive System You Can Live With

H. BRESSLER
Standards Foreman

AN EFFECTIVE INCENTIVE PLAN for a high level of production must consider not only the physical conditions of the working place and the equipment used but must also be based on some form of work measurement, so that earnings will be equitably related to effort and skill.

With this in mind, a program of rate revision was instituted within the limits of a well-defined company policy. Table I.

Although all incentive rates in use at the Hollinger had been of the "piece rate" type, Table II, we considered the feasibility of a "time standard" type of incentive. Since a time plan is more adaptable to operations where daily measurement of production is possible, and because piece rates were traditional in mining, it was decided to retain the piece-rate type for mine production and development, with standards (rates) determined by work-measurement. Standard hour plans, however, have been adopted for some operations both underground and in the surface shops.

The work measurement and development of standard times for both plans is the same.

Table II. Two Types of Practical Incentive Systems

STANDARD HOUR PLAN

1. Basic of the standard hour plan is time and is therefore independent of community base wage changes.

2. Easily understood by the operator since standards are nothing more than the time allowed to do any particular operation.

3. Changes to standards can be easily demonstrated since they are always a result of a change in the amount of work involved.

PIECE-RATE PLAN

Basic of piece-rate is money. Any change in base rate will necessitate alteration of rates.

Not so readily understood by all operators, since piece-rates must be converted to a time value before a comparison with actual performance can be made.

Always more difficult to explain changes due to the necessity of explaining the work-time-money relationship.

Development of Standards

Throughout the Hollinger underground operations, we have a wide range of conditions and methods that will never be as clearly defined or standardized as in the average shop or plant. If the results are to be truly representative of existing conditions and methods, timestudies must record all conditions sufficiently well that they can be recognized in their true perspective.

After the study times have been checked for accuracy by comparing the elapsed time of the study with the total recorded time, all elements in the study are listed on a separate work-up sheet for each operation. Non-productive times such as supervision, personal hold-ups, etc., are also listed so that a complete picture of the operations will be recorded on the work-up sheets.

When all elements have been listed on the work-up sheets, average actual times and effort ratings (See page 79) are selected from all readings for each element. A selected average is preferable to one determined arithmetically because the resulting average

1 **Samplers Daily Work Report**

Sampler J. JONES #6666 Date JAN. 12-51

Travel Level	Location and Level	Remarks	Vert. Travel	Work Classif.	Footage Cut	Travel Dist. Level	Travel Dist. Vert.
550	88 SH. W10-550			T.D.B.	21'	7500	
"	24 SH. W9-550			SP. Roof DR.	8'	2200	
"	MAIN SHAFT	DOWN TO 800	250			1700	250
800	226 E.M.1#2-800		140	S&F	12'	1900	740
"	226 E.M.1-800			DR.	24'		
"	MAIN SHAFT	LEAVE SAMPLES				1900	
"	22 SH. W7-3-800		134	RSE.	10'	1800	734
"	No. 11 SHAFT					2900	
Class		Std. Min.	Total	Total	75'	13900	524

Stope	No. 2	14	28
	Ft. 33	5.8	191
Raise	No. 1	23	23
	Ft. 10	3.8	38
Drift	No. 1	8.0	8
	Ft. 24	5.5	132
Sp. Roof	No. 1	9.0	9
	Ft. 8	10.1	81
Sp. Raise	No.	12.0	
	Ft.	14.9	
Grab	No.	5.8	
Test H.	No.	5.8	
Sub-Total			510

Class	Units	Std.	Total Min.
Travel, Level 100 Ft.—1 Unit	139	.6	83
Travel, Vert. 10 Ft.—1 Unit	52	.5	26
Work Allowances			
Shift Allowances			60
Transferred Sub-Total			510
Earned Total Minutes			679
Earned Total Hours			11.3
Base Hours			8

How the Standard Hour Plans Work in Sampling

IN SETTING UP the standard new plan, standard times were determined for level and manway travel, and different classifications of channel cutting—stope, raise, drift, and special roofing. Ground hardness was treated on an average basis except for special roofing. A special standard for excessively hard ground was set for this since a sampler may be required to spend several days' roof-cutting the same vein, consequently not encountering "average conditions" as is normally the case where approximately six different places are sampled daily. The responsibility of classifying hard ground by visual inspection and actual test cutting lies with the Sample Foreman.

All reporting by the sampler is done on a daily work report (Fig. 1). Level traveled, and the location and level of each work place visited are noted in order of occurrence. The remarks column shows irregular trips to the shaft station, reason for not sampling, enforced delays, high grade bagged.

Vertical travel distance is entered, as estimated to the nearest ten feet. Work class and actual footage cut are entered using the classification shown in the lower left corner of the form. The form is filled in to this point by the sampler and turned in at the end of the shift to the sample boss, who checks it against expected performance and checks the vertical travel distance for accuracy.

Office Work

The following shift, the sample clerk scales off level travel distance from prepared tables, and fills in the last two columns of the report which when totalled show total distance traveled during the shift. Minutes earned on cutting and travel are calculated, work allowances and standard shift allowances are added and the total minutes earned entered. The conversion to hours earned is then made and both hours earned and base hours are shown so that daily percent effectiveness can be drawn off the completed form, if desired.

After calculations are checked, the last two items of the daily work report are posted on an incentive summary chart, which shows each sampler's daily earnings in standard hours. The chart is posted for each boss's crew and the previous day's earnings can be seen by each man. The total hours earned by each man are computed at the end of the four-week period and payment made by applying the base wage rate to the total hours earned.

Advantages

Increase of about 10 ft. per man shift in footage cut.

Decrease in sampling costs of almost 2c. per ft cut.

Average incentive earnings of 26% of base wage.

(*Continued from preceding page*)

will more closely represent the time to perform the work element. Selected times are then adjusted to standard. The selected average multiplied by the effort rating factor gives the standard time for each element; the time required to perform the element at standard (100%) effort.

Data from numerous studies are recorded on a comparison sheet and selection of average element times made. A comparison sheet for each operation is prepared and all constant elements (elements whose time values are independent of any variation in the conditions of the operation) shown on the work-up sheet are transferred to this sheet. Time values are entered in standard man-minutes per occurrence, and classified as to the number of men performing the element. Pertinent details of the operation are also transferred to the comparison sheet.

As the studies progress a check of all times recorded for each element will indicate when sufficient observations have been made so that a selected time will be typical and the studies discontinued. The comparison sheet is then completed by selecting the time values for each element, adjusting the selected time by its occurrence factor and relating the corrected times to a measurable unit of production. A summary of all the elements and their corresponding time values will constitute a standard time for the operation. Elemental data developed in this way can also be used to provide consistent time standards for the same elements whenever they occur on new work which has not been timestudied.

Times for variable elements (those whose time val-

② Stope Work Method and Cycle Estimate

Effective Date.....

Stope Location 55 E.W. 14-2 Level 2900 Code 55-60 Cont. No. 442

DRILLING:

	Leyner
Longest regular shank	7 (9) 11 ft.
Approx. stope width	11 ft.
Lift height	12 ft.

Breasts per cycle	2
Holes in breast	17
Holes in vert. row	5 (+2 ON FOOTWALL)
Drill speed	12 "/min.
Scaling per breast	2 1/2 cr.-hrs.
Scaling per slash	1 cr.-hrs.

MUCKING:

Scraper equip. Class	1 (2) 3
Car size whbw.	½ 1 1½ ton
Sollar chute used	Y (N)
Scraper ramp used	Y (N)
Tons ore per lift	1100
Rock bolt holes per cycle	4
Block hole per cycle	1 cr.-hrs.
Secondary scale and sprag timber per cycle	2 cr.-hrs.
Stope length	ft.

FILLING:

Scraper equip. Class	1 (2) 3
Car size whbw.	½ 1 1½ ton
Approx. fill width	12 ft.
Sand or waste fill	S (W)
Plank or lagged floor	P (L)
Plank or lagged barric.	(P) L
Barricade regular or laid on fill	(R) lof.
Second. scale per cycle	1 cr.-hrs.
Clean down raise per lift	3 cr.-hrs.

③ Individual Incentive Rate

STOPE BREAKING

Level 2900 Location 5-5 E.W. 14-2
Code 55-60 Cont. No. 442

Breaking rate includes the following labour and explosive allowances.

Operation	Breast: Std. min. per Breast	Breast: Dollars per Breast
1 Set-up	130.14	2.10
2 Drill	797.64	12.85
3 Tear down	38.60	.62
4 Load & Blast (+ 2%)	140.27	2.26
5 Scale	375.00	6.04
6 Explosives (+ 2%)		12.31
7 Sample Waits	64.16	1.03
Totals	1545.81	$37.21

BREAKING RATE

Breast

Ft. Wid.	tons	cts./ton
9 "	72 "	52 "
10 "	80 "	47 "
11 "	88 "	42 "
12 "	96 "	39 "

BREAST TONNAGE = 11 × 8 × 12 / 12 = 88 TONS

SLASHING RATE

Leyner

Based on:	hole slash
	ft. shanks
Break	tons/hole
Rate 45	cts. per ton
Slash set-up	$5.45

How Piece Rate Incentives Work in the Stopes

IN ORDER THAT EXISTING conditions and method used in any one stope will be the basis of the incentive rates for that particular stope, a comparatively simple method of setting rates has been devised. First a statement by the foreman and shift boss, of existing conditions and proposed method, along with other pertinent facts (type of equipment, estimated scaling time, approximate stope width, etc.), is turned over to the standards engineer on that mine captain's beat. After receiving the method information from the foreman and obtaining drill speed checks, he uses this information and his standard time data to calculate rates for stoping operations. (See Fig. 2.)

Although some of the information is based on the foreman's estimate, his experienced judgment is sounder and certainly fairer than any average of mine-wide conditions. Stope work methods are reviewed each four-week period and the estimates corrected.

With the stope work method as a guide, it is simple to select applicable times for each operation from the standard data tables and to calculate the proper incentive rate. (Fig. 3). Mucking and filling rates are derived in a similar manner and the three rates (comprising approximately 80% of the total stope work) are summarized and sent to the mine captain for inspection and authorization.

Advantages

More "incentive" value because earnings depend on efforts rather than "good" or "bad" stope.

Foreman can determine most economical methods by getting rate calculated for each method.

Comparing unequal rates because of different methods makes supervisors more cost conscious.

ues vary with changing material or working conditions) are plotted against the variable factor (distance, weight, length, width, drill speed). From this curve, a standard time for any value of the independent variables can be read within the limits of original observation. Curve formulae are seldom calculated.

Before a standard time for any constant or variable element is used in calculating a production standard, a further adjustment is applied to compensate for the fatigue inherent in all manual labor. (See p. 87.) All other regular allowances such as lunch, travel, supervision, and personal time are either included in the final calculation of the rate, or stated as a separate piece rate per contract shift.

Changes in conditions, besides affecting work time, mean a change in method. Since these changes cannot always be anticipated, it is difficult to know in advance what rates should apply to any given working place.

For this reason, basic rate data have been set up in such a way that a rate for any set of conditions and method can easily be determined. For example, drilling times are affected by hardness of the rock. Drilling time data are therefore set up so that the time per hole can be read at a glance for different lengths of hole and drill speed.

Frequency of occurrence for irregular operations, usually related to units of production, is also a factor to be considered. Whether a leyner has to be set up, or a hoist moved once for every 50 tons or for every 250 tons produced can make an appreciable difference in the final piece rate per ton. Fuller realization of the variables involved and a logical method of treating them can be more clearly illustrated by individual stope incentive rates now in use at Hollinger.

JOB TITLE: TRUCK DRIVER

JOB DESCRIPTION

SUMMARY OF DUTIES

Under supervision of Warehouse Supervisor drive truck to pick up and deliver men, material, equipment and supplies.

WORK PERFORMED

Receive verbal or written pick up and delivery instructions; pick up and deliver men, material, equipment and supplies from various places inside or outside the mine property such as stores, dry, shops, freight, and express offices, local merchants, gravel claims, river pump station.

Perform minor maintenance or repair work on truck: change wheels in case of flats; dig truck out when stuck; gas up truck.

Perform related duties as assigned.

TOOLS AND EQUIPMENT

Use ordinary hand tools: wrenches, shovels, hammers.

REPORTS OR RECORDS

Make verbal report of work done, report mechanical defects in truck.

DIRECTION OF WORK OF OTHERS

Direct the work of one full time helper.

PHYSICAL EFFORT

Load and unload truck, usually by hand, involving occasional heavy lifting.

WORKING CONDITIONS

Truck cab heated, exposed to all weather conditions when loading or unloading truck.

1. Write a Job Description

Job analysts interview the immediate supervisor of each hourly-rated job and obtain the facts about each job. From this information they write up the job description defining the duties, responsibilities and organizational relationships of each job. Description will contain only such facts as are necessary to rate jobs fairly. Supervisors will be responsible for information contained in job descriptions, and job analysts for arranging the information into a standard form for job evaluation.

When job descriptions have been written, job analysts will check them with each level of supervision up to and including the superintendent of the department, with the stewards, and where practical with the individual employees involved. Copies will go to the union.

JOB TITLE: TRUCK DRIVER ..... Code No. .....

Factor	POSITION RATING DATA	Deg.	Pts.
Education	REQUIRES THE ABILITY TO READ AND WRITE	1	14
Experience	1 TO 3 MONTHS	1	22
Initiative and Ingenuity	REQUIRES THE ABILITY TO WORK FROM DETAILED INSTRUCTIONS INVOLVING THE USE OF JUDGMENT TO PLAN SEQUENCE OF WORK	2	28
Physical Demand	WORK INVOLVES CONSIDERABLE MOVING AROUND AND OCCASIONAL HEAVY LIFTING	3	30
Mental or Visual Demand	DRIVING REQUIRES CONTINUOUS MANUAL ATTENTION & ALERTNESS	3	15
Resp. for Equip. or Process	PROBABLE DAMAGE TO EQUIPMENT NOT LIKELY TO EXCEED $250.00	3	15
Resp. for Material or Product	LITTLE RESPONSIBILITY FOR MATERIAL & ANY LOSS IF IT SHOULD OCCUR NOT LIKELY TO EXCEED $10.00	1	5
Resp. for Safety of Others	CONSTANT CARE NECESSARY TO PREVENT SERIOUS INJURY TO OTHERS	4	20
Resp. for Work of Others	DIRECT THE WORK OF 1 HELPER	2	10
Working Conditions	PART TIME EXPOSURE TO ALL WEATHER CONDITIONS	3	30
Hazards	POSSIBILITY OF CRUSHED HAND OR FOOT AND BROKEN BONES	3	15
	TOTAL		204

2. Examine the Job Factors

Using the job description, each job is rated on the basis of the 11 factors listed in column (1) above. The extent to which each factor is involved in the job is explained in column (2).

Job Evaluation—A Good Way

N. J. GOODFELLOW
Occupational Analysis
Foreman

A FAIR DIFFERENCE in pay between jobs requiring different levels of skill is one of the most important elements of a good wage scale. It builds incentive into the job; provides a definite goal toward which the workman can strive without the stigma of a "speed-up."

Across the bargaining table in recent years, employer and employee have realized the necessity for some acceptable, standardized method of determining the relative worth of jobs to provide a basis for establishing equitable differen-

PHYSICAL DEMAND

This factor measures the job requirements which induce physical fatigue by means of exertion required (in weight and duration) and the straining effect of the normal work position involved.

Requires determining the duration involved in handling different ranges of weights (or equivalent exertion, pulling or pushing) or working in different positions.

1ST DEGREE—Work requiring little physical effort.

2ND DEGREE—Working regularly with light weight material or occasionally with average weight material. Operate machine tools where machine time exceeds the handling time.

3RD DEGREE—Sustained physical effort, requiring continuity of effort, working with light or average weight material. Usually short cycle work requiring continuous activity, the operation of several machines where the handling time is equivalent to the total machine time.

4TH DEGREE—Considerable physical effort working with average or heavy weight material, or continuous strain of difficult work position.

5TH DEGREE—Continuous physical exertion working with heavy weight material. Hard work with constant physical strain or intermittent severe strain.

Points Assigned to Factors and Key to Grades

FACTORS	1st Deg.	2nd Deg.	3rd Deg.	4th Deg.	5th Deg.
	— DEGREES AND POINTS —				
SKILL					
1. Education	14	28	42	56	70
2. Experience	22	44	66	88	110
3. Initiative and ingenuity	14	28	42	56	70
EFFORT					
4. Physical demand	10	20	30	40	50
5. Mental and visual demand	5	10	15	20	25
RESPONSIBILITY					
6. Responsibility for equipment or process	5	10	15	20	25
7. Responsibility for material or product	5	10	15	20	25
8. Responsibility for safety of others	5	10	15	20	25
9. Responsibility for work of others	5	10	15	20	25
JOB CONDITIONS					
10. Working conditions	10	20	30	40	50
11. Hazards	5	10	15	20	25

3. Measure Factors Against the Scale

From a fixed scale in the NEMA Job Rating Manual, the degree of each job factor is determined. For instance, the Physical Demand involved in the sample job was found to be of the 3rd degree.

4. Assign Weighted Points

Points are assigned to each degree of each factor. These are weighted according to importance. After the degree of each factor is determined evaluation points are found on this table.

5. Classify the Job

When all jobs have been rated, they are grouped into grades according to total point value. Chart (left) is typical, but will not be used by Hollinger.

Rate of pay for each grade will be established considering such factors as present rates of pay, prevailing rates of pay for comparable jobs in the community and industry, results of wage negotiations, and, very important, the establishment of equitable differentials between jobs. The last is an incentive in itself.

to Fix Fair Wage Scales

tials between jobs. Job evaluation provides such a method. It is a yardstick with which the job content of each job can be measured and the worth of each job determined in relation to other jobs.

Sound wage structure has been threatened during the past ten years by a series of across-the-board wage increases which have reduced the differential between skilled and unskilled jobs to the point where there is little incentive for an employee to develop the extra skill and effort required of the more highly skilled jobs.

In current negotiations with the International Brotherhood of Electrical Workers and with the United Steelworkers of America the problem of determining and establishing equitable rates of pay for the various jobs has come very much to the fore. To solve this problem, the company proposed to both bargaining units that a joint job evaluation program be carried out.

Earlier experience with job evaluation prompted the company's suggestion. In 1946 we undertook an experimental evaluation of hourly-rated jobs. Results indicated that our wage line was relatively flat and that a number of wage inequities existed. The flat wage line indicated that the rates of pay for unskilled jobs were comparable with the rates paid by other companies and industries but that the more highly skilled jobs were relatively underpaid.

While no corrections were made as a result of this evaluation (due in part to our inexperience with job evaluation and partly to local conditions) we have used it as a guide in determining rates of pay for new or changed jobs as they

have arisen since that time. The effort and expense required for this original work was well justified by the knowledge and experience gained.

In 1948, job evaluation work was done in salaried occupations. Salaries were adjusted in accordance with results, with the exception that no individual's salary was lowered. New or changed salaried occupations are described, rated and classified to fit them into the salary structure.

Although this work has not solved every problem, due perhaps to limited participation, it has provided management with a useful tool to assist in salary administration.

Will Use NEMA

In the company's present proposal, we have suggested the use of the National Electrical Manufacturers Association's job rating plan. One of the better known plans, it is easily explainable and understandable, and applicable to our hourly-rated jobs.

In proposing the NEMA job rating plan, however, the company has pointed out that there were numerous job rating plans which could be used equally well and asked both unions if they had a plan they would prefer to use. The company's view is that the particular job rating plan used is not important provided it is understandable and in accordance with established practice.

The Local of the International Brotherhood of Electrical Workers have had the NEMA job rating plan checked and approved by their research department and have agreed to the company's proposal to carry out a joint job evaluation program using this rating plan. The United Steelworkers of America's Local has agreed that some adjustment in wage differentials is necessary.

The proposed evaluation program was initially developed by the senior staff group and the over-all procedure checked by a management consultant. Some minor changes in procedure were made as a result of this check and the program was then presented to both bargaining units.

Four staff members were selected as job analysts and trained in the principles and application of job evaluation. The duties of these four job analysts will be to interview supervisors, write and check the job descriptions.

Explanatory meetings requiring from 7 to 8 hours were held with *all* supervisors in groups of 12 to 15 to explain the proposed program in detail. These meetings were held under the chairmanship of each department superintendent, with the explanatory material being presented by the occupation analysis foreman. Key-note of the meetings was the importance of the supervisor's part in the program.

Supervisory meetings covered: the necessity and purpose of the joint job evaluation program; the staff and line relationship between the job analysts and supervisors; the principles and application of job evaluation; the technique of describing, rating and classifying jobs; factors involved in establishing a wage structure; administrative procedure; and principles involved in obtaining employee cooperation and acceptance of the program.

Sound slides and written material were used to illustrate the explanation; job descriptions and job ratings were developed on the blackboard and the supervisors were given practice in describing and rating sample jobs. The meetings concluded with a true-false questionnaire and a period for general discussion.

In carrying out the joint job evaluation program seven to eight-hour meetings will be held with the union stewards and negotiating committees of both bargaining units and for a committee of those employees outside both bargaining units similar to the meetings held with company supervision. The emphasis in the meetings will be on the steward's part in the program.

Following the explanations to the stewards and negotiating committees two-hour meetings will be held with all hourly-rated employees. In these meetings the necessity of employee understanding and cooperation will be stressed. Sound slide films and written material will be used to illustrate the explanations; the rating manual will be reviewed and describing, rating and classifying jobs explained.

Administrative Procedure

Job descriptions will be rated by a committee using the NEMA Job Rating Manual. The rating committee consists of three permanent members, two staff and a union representative, and a temporary section, made up of department supervisors and union stewards, which will change from department to department. The permanent members maintain consistency in ratings in different departments and keep records of the decisions and proceedings of the rating committee.

A number of key jobs will be selected and rated first to determine and establish inter-departmental job relationships and to provide bench marks to guide the rating of the remaining jobs. Job ratings will be expressed in numerical point values for individual job factors, and in sum for the total job content of each occupation.

When all jobs have been rated they will be grouped into a number of job classes according to their total point value. The resulting chart of job relationships will be made available to the union and posted for the information of all employees.

Employees will be given the opportunity to question their job classification on the basis that either the job description is incorrect or the job rating is incorrect.

If a man in the bargaining unit is not content with the classification of his job after checking it with his supervisor, he may take the matter up according to a procedure dealing with differences of opinion, including outside arbitration. In such cases, the arbitrator would be a firm of management consultants agreed upon by the company and the union.

Job rates which are under the evaluated rates will be increased to the evaluated rates, within the limitations of the company's monetary proposals. Men engaged on such jobs will receive the increased rates.

No Pay Cuts

Job rates which are over the evaluated rates will be decreased to the evaluated rates, but employees engaged on such jobs at the time the decreased rates go into effect will not have their rates decreased while on that job. These employees will not participate in future wage increases as long as their rates are above the evaluated rates.

New employees or men transferred to a different job will receive the evaluated rate for the job.

New or changed jobs will be described, rated and classified in the manner outlined.

If the company and union are unable to agree upon the description, rating or classification of any job, the company will put their classification into effect and the employees concerned may take the matter up as a difference of opinion as provided for in the agreement.

Guide to Human Relationships

T. E. HAWKINS, Manager, Industrial Relations Division

"One of the first problems is to make our industrial society something employees can and will accept, while efforts must be made to limit the possible areas of conflict between employees and employers and to extend the areas of cooperation. The human problems are industry's greatest challenge and opportunity."

EFFICIENT PRODUCTION is accomplished only when a company has a cooperative body of employees. It cannot be stressed too strongly that the successful use of advanced management techniques, fair incentives and even new methods and equipment depends on their acceptance by the employees.

Further, management has spent an untold number of dollars on the development of new methods and new equipment for improving production, yet in the minds of employees there must be hundreds of unused ideas for increasing productivity. Obvious questions to ask are: How can these ideas be put to work? How can improved methods and equipment be put to work with the employees cooperating rather than bucking change? How can the will to work be developed?

To seek these answers and to develop and maintain sound employee-employer relations, the Industrial Relations Division was organized. Its principles of operation are perhaps best illustrated in the attitude with which it was launched. The IRD was not set up and told by operating supervision, "Now you get busy and solve our employee relations problems and let us get on with our mining and milling."

Rather, the manager and superintendents took the attitude that they had to solve these problems and that they needed the best help they could get. Responsibility for good industrial relations does not rest with this Division alone. It cannot do so when all the relationships between all the people in the organization are involved.

Industrial relations may be best described as a permeating function. Ideals and attitudes of the program must permeate the whole organization. As in a safety program, if it is to be highly successful, everyone must support the program and be part of it.

Not only is the function of the IRD a permeating one, it is a staff function. Failure to recognize these two facts have foundered more personnel programs than any other cause. Recognition of them at Hollinger and the rigid way in which they have been adhered to are responsible in a large measure for what success has been obtained.

Rules which must guide the relationship between line supervision and the IRD as a staff division are simple:

The Division and line supervision have joint responsibility for all matters pertaining to industrial relations (employee relations, accident prevention, employment, training, communications with employees, etc.).

Direct authority for all these matters rests entirely with the line supervision.

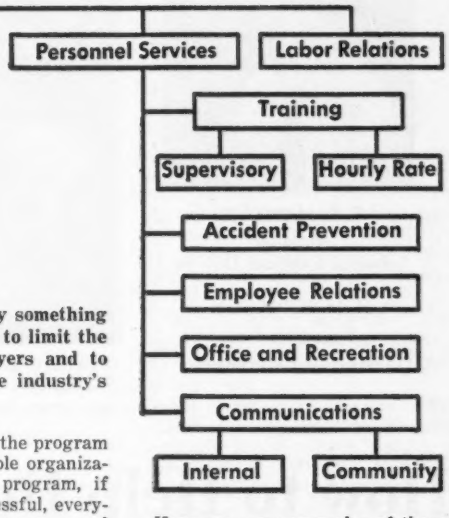
The Division's share of the responsibility is to assist and give advice to line supervision.

It does whatever work is necessary to enable it to give the best advice or be of the most assistance when called upon.

Line supervision is responsible for understanding the purpose of the IRD and for using its services.

The Division is responsible for establishing an "authority of ideas" through its own competence.

The Division must also work at the lowest level of supervision of the organization, consistent with authority for action, if it is to follow sound principles.



Here are some examples of these principles in action. If an employee claims a grievance under collective bargaining agreement, the IRD must be in a position to advise the supervisor how, considering individual circumstances, the terms of the law, the Union agreement and company policy, he can best handle the problem.

Any safety problem that is the responsibility of a shift boss, the safety inspector assigned to that problem and who thus has joint responsibility for solving it, works with the shift boss. He does not go to the mine captain or mine superintendent. If the inspector cannot accept the final action of the shift boss as satisfactory, he refers the problem to the shift boss' superior. If both shift boss and inspector understand this relationship there is no antipathy. They both go to the superior for help in solving the problem. If either does not understand the relationship, friction is bound to develop.

Line personnel rapidly came to understand the purpose of the industrial Relations Division as a result of joint action taken to determine the program, together with the work done by the Division personnel in making the line supervision aware that industrial relations problems existed. As rapidly as the Division was able to establish that it was competent and that it could and would give service, just that rapidly did the line supervisors start using its services.; just that rapidly did they start asking for further services.

T. E. HAWKINS
Manager
Industrial Relations Division

H. M. FERGUSON
Superintendent
Personnel Department

STAFF CONFERENCES are held to discuss particular problems, or for the development and education of staff members. Considerable experimenting has been done with various type of conference. To date, role playing seems to be the most effective as well as the most enjoyable.

How to Help Develop Supervisors

Supervisors are the backbone of the production team. Management's job is to help them develop their own potentialities and those of the subordinates to the utmost.

WITH THE BOARD OF DIRECTORS at one end of the organization and the employees at the other totally dependent on one another, an uneducated supervisory body midway between is economically intolerable. Major emphasis therefore is on supervisors and executive development.

An efficient organization cannot be without supervisors and executives who (1) know the latest technical developments in their own field, (2) have detailed knowledge of their company's philosophy, objectives, policies and procedures, (3) are well grounded in the best management principles and techniques, and (4) above all, have an attitude that permits them to continue learning, to improve, and to be a part of an integrated management team.

We insist that when one of our supervisors is promoted, retired, or leaves the company, that there be a ready replacement for him. That replacement must be as good a man, if not better, than the man he replaces. To be a good supervisor in 1960, a man will have to know more than he did in 1950.

Finally, the corporation that assists its individual employees to a fuller enjoyment of life, to an appreciation of more good things, which come as a result of education and personal development is fulfilling a responsibility to society.

There is nothing new in principle in the Hollinger program, although some different techniques have been developed for particular situations.

Here are the key points of the Hollinger program to develop top flight supervisors. (1) Development must be carried out through the line organization, that is, carried on by each supervisor with his subordinates. This is fundamental. If supervisors do not permit and encourage their subordinates to develop on the job, it is unlikely that they will develop themselves, and even auxiliary programs run by staff departments are of little value. (2) Encourage and assist the development of Hollinger supervisory personnel by auxiliary means. (3) Select good supervision material and train well before using.

Developing the Line

At Hollinger, each supervisor is responsible for the development of his subordinates. Each fulfills this responsibility in his own way according to his own personality. However, each supervisor's program must have these points in common—he must set an example, he must make sufficient information available to his subordinates, he must keep "decision making" at as low a level in the organization as possible, and he must develop a true spirit of participation among the men with whom he works.

Keeping subordinates sufficiently informed is a major task. Every supervisor must pass along: (1) The information his subordinates want and (2) the information he thinks they should have. People will retain information they seek but it's almost impossible to get people to absorb information not directly related to their immediate work situation. Confidence in the supervisor and the company must replace much detailed information which can't be transmitted. But all supervisors must be able to get satisfactory answers to questions about the job that they and their men consider important.

Supervision must ensure that decisions are made at the lowest possible level. In most organizations decision-making tends to creep up the line, so much so, that the senior executives became handicapped making decisions that should not concern them and about which they lack detailed knowledge. The poorest supervisors insist on making all decisions themselves. They have yet

PARTICIPATION helps in making decisions. Mine Captain Len Bound discusses work with Foreman Chalmers and Shift Boss Dion.

ASSISTING DEVELOPMENT of subordinates is essential. Foreman Glenn Smith shows Shift Boss Jerry Minogue where to get the facts.

to realize that a person learns to make decisions and take responsibility, by doing just that, not by reading about it.

Participation in decision making is required from all levels of supervision. A procedure for settling differences of opinion is absolutely necessary. Settlement of these differences by participation strengthens the organization and it is certain that the strength is needed at the bottom. Supervisors at Hollinger deeply appreciate their opportunity to participate in decision making in a friendly atmosphere with their supervisors. Participation is a method of supervising, of leading, that is practiced in all daily contacts. It's the difference between the boss who asks how you plan to do the work and the boss who says "do it this way."

Executives and higher levels of supervision must also hold staff meetings. These meetings are one way to develop team spirit, and to pass information up and down the line.

Auxiliary Means of Assisting Personal Development

If a member of the management team accepts his responsibility for assisting the personal development of his own men then he and his men can be helped by an auxiliary program. These programs must offer both general background information and specialized knowledge on particular subjects.

Three major divisions of the auxiliary program are: (a) Methods Used to Establish the Management Team. (b) Use of the Printed Word to Disseminate Information, and (c) Other Means Used in the Development of Supervisors.

We soon saw that we had to make it clear that all levels of supervision and the technical personnel are practically, as well as theoretically, members of our management team. This must be done by each supervisor with his subordinates but there are certain practices that can be employed effectively on a company wide scale:

(a) Have all members of supervision on salary and receiving the additional staff benefits. Also, maintain a reasonable differential between each level of staff and between the first line supervisor and his men. The relationship between the various rates is now maintained according to a systematic procedure of salary evaluation.

(b) Make a real effort to have all members of management participate in solving company problems. Pool ideas. Have each supervisor know the organization's objectives and performance. Discuss *our* problem and what *we* should do about it, rather than *my* problem and what *I* am going to do about it.

(c) Have members of supervision (particularly first line) act as company representatives whenever possible. For instance, the Industrial Relations Division conducts evening classes and recreational programs for employees. Every effort is made to ensure that the line supervisor realizes that these are held to assist him and an employee attends evening classes only on the recommendation of his immediate supervisor. Incidentally, supervisors have learned that the value of the evening classes to their men is in direct proportion to the amount of interest they take in those attending.

Another example—the company gives turkeys to the families of married employees at Christmas. At one time slips for turkeys were handed out at the Time Office. Now the supervisor, as company representative, distributes the slips himself.

Many other incidents, none major, none spectacular, help to stress that all supervisors are part of the team.

(d) Make sure that each understands his own job and its relationship to all others, and to so set limits of authority, that each must use his own judgment—and not be a robot, rigidly controlled by rules and regulations. Keep decision making at the lowest possible level consistent with efficient operation.

As an example, first line supervision is given no rules, no standards by which they can rule on absenteeism without regard to the individual case. When the first organized efforts were made to reduce absenteeism, some asked for a rule to follow. This rule was refused. The guiding policy was laid down that when Hollinger hired a man it was prepared to have work available for him regularly day in and day out. When the man accepted employment he accepted the responsibility of being at work regularly. Under certain circumstances, neither Hollinger nor the man can fulfill his requirement. The supervisor's job is to see that his men live up to their side of the bargain when reasonably possible. No one else can establish that one of the supervisor's crew will be laid off for absenteeism when his wife was sick, while another man will be allowed to miss time for pay day sprees.

Each supervisor reviews each man's record every 6 months. Included are absences from work and the reasons. If the man is delinquent, the supervisor sees him as an individual. He must, in every case, talk the situation over with the man. When the supervisor has all the facts he must use his own judgment as to the best way to get his man to do the right thing.

Using the Printed Word

At Hollinger the printed word is used to share accurate, authoritative information with the supervisor about a wide range of problems before he had to deal with these problems with his employees, the union or the public. This phase of the IRD is discussed on p. 100.

Other Tools in the Development Program

Other methods to assist development of supervisory and executive personnel include: (1) Attendance at conventions and conferences. (2) Inter-plant visits. (3) Transfers from one department to another. (4) Conferences organized by staff.

These means may be time consuming, but they are designed to get the individual to think for himself, to deal with his own problem, and to get people to assist each other. There is more opportunity to get cumulative thinking of the group on a problem. Where time permits, discussion reveals weaknesses in policies and procedures and potential irritations are discovered before they become a major source of trouble.

We have found that attendance at good conferences and good conventions, is most effective in jarring people out of their own particular rut. Men return with confidence in our own organization that we are on the right track in many ways but that there are still many ways in which he and Hollinger can improve. The company insists on written and verbal reports to fellow supervisors from those attending any conference.

In the last four years some 40 persons from Hollinger have attended different conferences including University of Iowa "Summer Management Course," the Stevenson & Kellogg two-week Management Refresher Course, Princeton University's Graduate School of Conferences and Seminars on Industrial Relations, conferences on purchasing, safety, job evaluation, the Dominion Council of Foremen's Club and safety and technical conventions.

Attendance at these conferences has played a major part in ensuring a flow of new ideas and continued enthusiasm among members of the Hollinger staff.

As an organization grows, it gets harder to have understanding and acceptance by the line of the many varied and staff activities. This is a major problem because the staff is of very limited value if the line supervisor does not know its purpose and how to use it. On the other hand, impractical recommendations from members of the staff do not endear them to line supervisors.

Continued effort is made at Hollinger to avoid this condition. One of the best methods is to have supervisors experienced in staff functions and the men in the staff department experienced in operations. We try to transfer men throughout the organization. Many of our mine supervision have worked in one capacity or another in the Industrial Relations, Production Engineering, Surveying and/or Exploration and Development Departments. On the other hand, most of our key staff men have had experience in operations.

Another procedure is to use temporary but full time committees on which line and staff personnel work together on current problems.

We have found that visits from outsiders to our organization can be stimulating. We try to have visitors come in contact with as many of the lower levels of supervisory personnel as possible. Often meetings are arranged so that foremen, superintendents and others can question and be questioned.

Because of the emphasis placed on supervisory development at Hollinger, we do considerable experimenting with various techniques of holding conferences. We have used several two-hour conference type discussions, akin to the Training Within Industry Courses sponsored by the Government during the war, and had varying degrees of success with them. We find conferences of this type are useful for the informational type meeting, but certainly are not efficient.

"The Job and the Mine Supervisor," a two-week course, and "Time Study Appreciation," a three-week course, were major conferences run in the past three years.

"The Hollinger Supervisor and Accident Prevention" conference, held in 1950, were particularly successful. Supervision attended in groups of approximately 15 for two full weeks. Two books were required as supplementary reading: "Working With People" by A. Uris and B. Shapin, and "Production With Safety" by A. L. Dickie. Six slide films and seven conference leaders were used. Ten hours were spent discussing the Mining Act under the leadership of the local mine inspectors.

Instructional, informational, developmental types of conference discussions were held. Examinations and tests were used effectively. Actually, practice try-outs on the job, in combination with role playing, proved to be probably the most enjoyable and most effective technique.

Typical situations were used for role playing. Each supervisor, including the mine superintendent, was assigned to play a role. For example, a shift boss was chosen and told that he had had an excellent crew with whom his relationship had been good but the crew had "gone sour"—the men tended to be sullen and short. His problem was to find out why and get them "back on his team."

The supervisor playing the role of the worker was told to act as if he had found out that his supervisor had been telling stories about him and had told the mine captain that he was a poor miner. His crosshift told him about it and had spread the story among his fellow workers.

The rest of the group heard what both men knew and watched the "supervisor" try to bring his man back to the status of a satisfied employee.

Problems chosen for role playing dealt with accident prevention, unions, quarreling between shifts, introduction of new methods and equipment and many others. It was found to be an enjoyable method of quickly demonstrating important points.

We found it possible to gain considerable enthusiasm about conferences without accomplishing much. Putting to work what is developed in the conference, is unquestionably a job for line organization. This makes it necessary for top executives to attend conferences first, to whole-heartedly accept what is developed, and then practice it with their own subordinates.

Pre-Supervisory Training

For some years we stressed training and assisting those who were already supervisors to improve their performance. We soon realized that selection of supervisors and their training, before they were given supervisory responsibilities, was important too. The problem that faced us was to decide what was a supervisor's job, the qualifications needed, and how

to determine if a man has these qualifications or assist him to develop what he lacks.

Choosing New Supervisors

Experimenting, we found that a job could be described and the qualifications determined but as yet we have found no infallible method for finding out if a man will make a good supervisor until he has actually been tried out on the job.

These facts will help in making a decision, however.

(1) His outside activities. Is he a leader in the church, community, or other places where leadership is earned on a voluntary basis? They often reveal his ambition and initiative.

(2) Psychological tests are not 100% accurate but they certainly provide a basis for discussion with the man as to his interests, his personality and his abilities. Some potential supervisors had everything they needed except the necessary knowledge of arithmetic to administer our incentive plan. This lack of ability turned up in tests. These men were advised of their weakness and then taught the necessary arithmetic.

(3) Detailed records of his work histories at the mine. If he has a poor accident record, why? After all, if he is expected to get other people to *want* to work safetly, his background should be studied.

(4) His personnel record at the mine should reveal his education, formal or otherwise; whether or not he has sufficient technical knowledge and experience.

Most important in the search for supervisory talent is the interest of each supervisor in the development of the men who work for him. Nothing demoralizes a man, or an organization as quickly as when bosses, who are requested to let one of their men go for a promotion or further experience, say "you cannot have that man, he is too good where he is."

After you have selected the potential supervisor, he still has no knowledge of a supervisor's job. Here's how Hollinger helps him obtain this knowledge.

When the number of spare shift bosses available for vacation, relief, etc., is insufficient, a group of men are selected by the above processes, from recommendations made by mine supervision. More candidates for a pre-supervisory training course are chosen than there are jobs available. With men who fail to make the grade every effort must be made to assist each individual to adjust himself, to acquire additional education or to develop other aptitudes.

The pre-supervisory course has 18 lecturers representing different phases of company operations. Each gives a talk on the supervisor's job which is followed by discussion. Visits are made to related departments such as Pay Office, Cost Accounting, Survey, Geological, Industrial Relations, etc.

Tips For Success

Value of the first course was so apparent the first time that it has been given to all first-line supervision in the company. Important features that assisted in making it a success:

1. The general manager started off each two-week session.

2. Bound copies of all the talks were distributed to each participant. (Much of this information had never been made available previously to supervision.)

3. Each speaker is asked to prepare a brief examination covering what he considers the most important points of his talk. The speaker marks the papers for his tests. This particular technique has resulted in greatly improved talks. For example, one of the most important points of my talk on labor relations obviously was not registering with the first group. I had to try different presentations and different methods of emphasis until the point was made clear. Obviously if 50-60% of a group did not understand some part of a talk that the speaker considers important, there has been something wrong with the speaker's presentation.

4. At the beginning and end of the two-week session, the group was given a test on "How to Supervise." Comparison of results indicates the extent of improvement and shows clearly what information is not reaching or not being retained by the men.

5. Participants found it much easier to get interested in a two-week course than in any series of two-hour talks. Since they are relieved of their regular duties, they can concentrate all their time and energy on learning.

6. Men were able to dress comfortably for the course. Underground clothing is not designed for comfort at a conference table.

7. Active participation of so many men in putting on a course insured a much better follow-up on the job and much better acceptance. Experienced speakers brought practical problems to the conferences.

8. A two-to-four hours free discussion period for the group at the end of the course helped speakers improve the course. The group appointed their own chairman and discussed the course from several angles: What did they get out of it? Was it worth while. How can it be improved. They also reviewed individual topics and each speaker's presentation. Recommendations presented to their own supervisor tended to be direct and to the point. At least two speakers completely revamped their material and improved it immensely as a result of the comments from the group.

9. The man assigned to handle arrangements of the course, follows up with each individual. He uses results of the two "How to Supervise" tests, examination results, and notes he makes himself during the course, on each man's attitude, alertness, and participation. Following completion of the course, he personally delivers each man's marked exam papers and arranges to spend at least half a day with him on the job, and even many hours off the job, to discuss the individual's apparent lack of knowledge and/or misunderstanding where it is revealed by the exams. This follow-up was particularly well-received and helpful.

Development of a production team, consisting of more than 2,000 employees, requires some highly concentrated and continuous efforts towards people. Success achieved by such efforts depends on how well you realize the fact revealed by psychological research that production-minded bosses do not get as much work from their men as do the people-minded bosses. Which would you work hardest for: a boss who was interested in you or a boss who was interested in how many tons would be produced today, tomorrow and the next day?

WHAT'S YOUR OPINION?

	TRUE	FALSE
1. The best place for a young fellow to learn mining is on the end of a muck stick.	☐	☐
2. If a young fellow is any good at all, he'll train himself.	☐	☐
3. The mining industry badly needs more good young men in supervisory jobs.	☐	☐
4. Gold mining companies can't compete with other industries in attracting good young men.	☐	☐
5. Mining companies must cooperate more closely with mining schools in giving students practical experience.	☐	☐
6. It's a waste of time and money to train most young graduates. They'll only go to work for someone else.	☐	☐

Here Are Hollinger's Answers:-

1, False. 2, False. 3, True. 4, False. 5, True. 6, False.

DID YOU AGREE? Read this challenging article to see what's back of their views.

Trained Young Engineers— Your Soundest Investment

ONCE UPON A TIME a would-be captain of industry was regarded with suspicion unless he had spent his early years straining his back in the heavy-lifting end of his business.

Whatever justification there may once have been for this attitude, has vanished long since. The basis for that idea has gone with the world in which boys went to work as grease monkeys and wound up chairmen of the board.

Today's industrial leaders need technical training to cope with the over-increasing complexity of today's, and tomorrow's problems. Mining is no different from any other industry. The future advances in mining techniques will be the work of highly specialized technical men, who may have had little experience in so-called "practical" operations.

University training, or the equivalent, is needed in filling today's positions of responsibility.

This is as it should be. If the school has done its job, a university graduate will have developed a keen sense of problem analysis, an ability to think clearly, and a knowledge of where to go to get relevant information. These are among the best attributes a good executive can have.

STANLEY G. IRELAND
Supervisor Of Mine Planning

Engineers Were Lost

Here at Hollinger, it became obvious in recent years that the company's attitude toward university graduates must change. There had been no attempt to train young engineers, the feeling being that the college had done the training and the rest was up to the man himself. The result was that many good young men were let go by default simply because neither they, nor the company, ever learned what the other really had to offer.

As time went by, fewer recent graduates came to Hollinger. Quite a number of older graduates left the company for other organizations. By the time this trend was recognized, a serious shortage of technical men had developed, even considering the small number of engineers the company thought necessary at that time.

This shortage of graduates grew worse during World War II, when the armed forces took so many men out of the universities.

Hollinger Was Worried

After the war, Hollinger, along with the rest of the gold mining industry, was up against it, economically, the company needed help. Costs were up, equipment was old, mechanization and development were at a standstill. The present was hazardous, and the future looked worse. Obviously, more technical specialists were needed, and management decided to comb the universities thoroughly to get men with the sound technical training that was required.

It was accepted at the outset that a gold mining company would have difficulty competing for good men with other industries, in terms of potential salary, therefore, the management made up its mind to create opportunities at Hollinger that would attract, and hold, good technical men.

New Program Started

In 1947, Hollinger began a new program to improve the selection and training of university graduates. The first step was to get the right men. This was done in three ways:

1. The Ontario Mining Association sponsors a program under which graduates may work in three different mines in the province in a year, usually a large gold mine, a small gold mine, and a base metal mine. Hollinger is included in this plan.

2. Hollinger had a policy for years of employing university students during vacation periods. This practice was stepped up, and special attention given these students so that those with good records might be invited to join the company when they finished their formal engineering education.

3. In addition, a representative of Hollinger's Industrial Relations Department visited Canadian universities during the winter months to interview coming graduates as possible Hollinger employees. These visits are being continued on an annual basis.

Selecting Good Men

In selecting technical graduates to be offered the opportunity of joining the Hollinger organization, several methods are used. In the first place, the interviews at colleges are a guide to suitable men. Also, the performance records of students working at the mine are useful. Third-year students are rated with particular care by their supervisors during their work periods at the mine. Another method is to interview professors in regard to the qualifications of their students.

Psychological testing also helps in choosing the right man for the job. Hollinger has used these tests in some cases. Aptitudes, capacities, strong interests, and personality traits are all brought out by these tests, if properly handled. We recognize that this testing is not infallible, but we do regard it as helpful.

Out of these methods, then, there is built up a small group of possible candidates. Each man in this group is interviewed by a Hollinger representative. Based on these interviews, recommendations are made to those department heads who need technical personnel. These executives make the final selection.

Young engineers coming to Hollinger are given a training period of one year, during which the objective is to teach the new man what he should know about the company, its policies, and its methods, and to find the right job for him.

He receives a guaranteed minimum salary during this period, and he has some of the same privileges of the regular staff, a sick leave of four weeks with pay during the year, for example. At the end of the year, if an opening occurs for which he is fitted, he is given the job at that time. If there is no immediate opening for which he is clearly suited, but he wants to stay with the company, he is given an increase in salary, an interim job is found for him, and he is carried on the staff until the desired opening occurs.

The Training Year

The first step in the recent graduate's training year is an explanation of company policy. It is most important that any staff members who have, or who may someday have, administrative duties, be familiar with all matters of company policy.

Following this study of company policy, the graduate goes on to actual training. If his aim is mining, he spends six months in underground work. He learns Hollinger mining methods and gets acquainted with all the old and widely-scattered mine workings.

He works briefly at a wide range of jobs: switching on a motor, chute pulling, track maintenance, timbering, machine helper in drifting, raising, stoping, and finally as a machine runner in a stope.

Note that he is getting practical experience without the frustration of laboring, apparently indefinitely and forgotten, in some remote area of the mine. He isn't pampered, any more than any man learning a new and difficult job needs to be pampered.

After six months, we go over the graduate's progress with him. If all is well, he goes on to other parts of the company to get some idea of the interdependence of all the several operations. He puts in his second six months in the mill, the shops, the geological department, the production engineering department, personnel department, or any others in which he is interested. Spending several weeks in each, in actual work not just observation, he gains an essential insight into the manifold operations that make Hollinger work.

During his training, the graduate can attend any supervisory conferences that may be held. These have done much to improve efficiency in recent years, and by attending them, a graduate can keep abreast of improved practices as they are developed. He is also encouraged to attend the Hollinger evening classes, which feature discussions of the company's operations and policies.

Cooperation among departments is an essential of good management in any plant. The type of training course we use gives trainees a chance to see at first hand the problems of departments other than the one they are primarily interested in. This should develop a spirit of tolerance and understanding of the other fellow's problems, both useful attributes.

Also, although the trainees do not work long enough at any one job to reach proficiency in it, they do get a taste of everything and are better able to choose the work they prefer after their training.

On The Job

During the training period, the graduate works under several supervisors. The combined, and therefore unbiased, view of these men is considered in selecting the possible places into which the graduate can fit at the end of his training period.

At that time, all the accumulated record of the graduate's work is evaluated. If it is satisfactory the trainee is offered a definite position in the company, when a suitable one is vacant. He is under no obligation to accept it. Or if he wishes to stay on and a suitable job is not open just then, he is invited to remain on the staff at increased pay until a position becomes vacant.

In fact, the trainee is free at any time during the year, or after it, to leave the company for what he may consider a better opportunity with some other company. We don't expect that all of our trainees will stay with us.

But by giving fair treatment and a good opportunity to those young men willing and able to work for it, Hollinger is assuring itself of the best possible management for the future. The company should always have sufficient technical personnel available from here on, because Hollinger's reputation is bound to grow as a place where the only limitation on a man's progress is his own ability and drive.

Proper Induction Saves Money

MICHAEL STEEL
Supervisor Of
Employee Relations

R. C. THOMSON
Supervisor Of
Recreation

DOING A GOOD JOB of recruiting, selection, placement and induction of new employees saves the supervisors' time, and the company money by reducing labor turnover, need for retraining, numerous transfers and dissatisfied workers. The Employee Relations section gives guidance and assistance to busy line supervisors in doing this work.

Recruiting is mainly limited to those applying for jobs at the mine. Some advertising has been done and two recruiting campaigns conducted, one in Great Britain and one to bring in 130 displaced persons.

Selection. We try to put a man at ease from the time he first enters the employment office. We tell him all he wants to know about the company and help him fill out his application. After a private interview we can tell him if there may be a job for him. Selection of new employees is determined by the interview, past record at Hollinger, if any, and a thorough medical examination.

Placement. Proper placement is important in maintaining an effective working force. To keep the round peg out of the square hole, we take into account (1) the man's experience, ability, physical fitness and his wishes; (2) Working hours of the job; If shift work affects his home life unfavorably, he will soon seek a transfer. This creates the same opening again, or a dissatisfied employee. (3) Economic adjustment of the man; A skilled miner, used to high incentive pay will be dissatisfied if placed on day's pay work, with earnings fixed.

Induction. The induction program is designed to foster the feeling of belonging—to impress upon the new employee that he is working with a company, not for a company, and that we require his services as much as he requires the job. The initial phase of induction takes 2 hours and the man is paid for his time. The procedure is standard.

(1) Tell him about various benefit plans and about rate of pay, holidays, work periods, etc. Invite questions to ensure his understanding and to show him that we are willing to help. Give him four booklets to be read at leisure covering information he should have.

(2) Escort new man to pay office and introduce him to paymaster. The new man signs his employment card, receives his employment number.

(3) Take him to his department to meet the safety engineer who informs him of safety precautions and regulations. He receives a copy of the safety rules, a first aid kit and safety glasses, all provided by the company.

(4) Assign him a clothing locker and tell him about time cards, showers, change room, etc.

(5) Introduce him to his supervisor. Since it's natural for him to feel somewhat nervous, the supervisor tries to put him at ease talking about Hollinger and the work.

Before he actually starts work, each new employee understands what he may expect and what is expected of him. Much of the normal uncertainty and lack of confidence have been eliminated.

But the interest of the Employee Relations section doesn't cease then. Periodic checks are made.

(6) After 6 weeks, the supervisor submits a rating report on the quality and quantity of the man's work, his adaptability, dependability and general attitude. Before submitting it, the supervisor discusses the report with the employee, making sure he understands and agrees with the rating, and has him sign it. The report aids in showing the new employee how to improve his work or in complimenting him on progress. Supervisor and employee also get to know each other better.

(7) At 11 weeks, there is another report. Experience shows that in almost every case, shortcomings discussed earlier with the employee have been cleared up.

(8) Employee Relations now contacts the supervisor to see if the employee is suitable and asks the man to come in for a final interview. His work is discussed. Any suggestions he has are dealt with and any questions are answered. If he is suitable he goes on the pay roll as a permanent employee. If not, we explain why he is unsuitable for the type of work, and if other work is not available, he is released.

Further contacts are limited to counselling on personal problems when requested by the employee or supervisor.

Records. The section gives further aid to the supervisors in keeping up to date personal records of all employees for use of the supervisor in solving an employee problem.

HOLLINGER HAD THESE PROBLEMS

After The War

THE PROBLEM:—

How to step up production and hold down costs with few skilled miners and a labor turn-over of 50% a year.

THE SOLUTION:—

Establish training stopes, manned by a few skilled instructors, to teach basic mining rapidly. Let supervisors teach advanced mining.

From 1948 On

THE PROBLEM:—

How to re-train skilled crews in new methods involving increased mechanization. How to increase skill of entire work force.

THE SOLUTION:—

Return all training to supervisors, but back them up with trained instructors for special jobs to speed up training in new methods.

Success Of These Methods Makes Hollinger Sure That . . .

Better Miners Aren't Just Born—You Can Make Them

BRUCE ROSS
Assistant Mine Superintendent

IT IS THE EFFECTIVENESS of each individual employee, multiplied by the number of employees, that determines whether or not a profit is won from a ton of ore. To gain the greatest possible effectiveness in the shortest time, a well-planned and executed training program is essential.

That isn't easy. If every man would only use correct methods, observe safe practices, and work conscientiously at a reasonable speed, there'd be no problem. Unfortunately, most people don't work that way unless they are shown why it is to their advantage to do so. Showing them why, and how, is the function of training.

Although Hollinger has had an employee training program for many years, it is only within the last five years or so that the problem became acute and the need for better training methods urgent.

The problem had two phases:

1. During the first post-war years, labor turnover ran as high as 50% per year, and there were few skilled miners available.

2. In late 1948, turnover dropped, but increased mechanization and other new methods demanded re-training of most of the crews.

Hollinger's plans to handle these problems were initiated at a high level in the company and definite programs were thought out and carried through. These plans required constant alteration to keep pace with changing conditions.

Line supervisors have been responsible for planning most programs, with the assistance of service departments like the Industrial Relations and the Production Engineering departments. This assistance might take the form of working out detailed plans for instruction, or, at times, providing trained instructors to assist the supervisors.

Coping With High Turnover

When World War II ended, Hollinger ran into a labor turnover that went as high as 50% a year. Few of the men available had ever worked underground before. In the winter of 1947-48, the company tried to help the situation by bringing in some 250 displaced persons from Europe.

Hollinger had always depended on the supervisors to do the job training up to that time. But this deluge of untrained men was too much to handle with the old methods. Two new programs were instituted: 1, a level in the mine was set aside as a special training level; 2, all supervisors and instructors were asked to attend a series of J. I. T. (Job Instruction Training) conferences.

By establishing one common training area in the mine, the management made it possible to teach new employees the basic principles of their jobs in the shortest possible time. The instructors on this training level could devote all their energies to training, and do it in ground with which they were thoroughly familiar. On the other hand, line supervisors were relieved of the burden of giving basic instruction in mining.

Normal training time in basic mining methods was two weeks. A foreman was assigned to supervise the training level and keep track of work done there. There was also a shift boss on each of two shifts. Actual instructing was done by several skilled miners chosen for instructing ability.

The points a man ought to know before he took his place as a helper in the mine were set down in an instruction manual, prepared for use on the training level. The material in the manual had all been read and approved by the

This Is The First Page Of Hollinger's Instruction Manual In Basic Mining

INSTRUCTION MANUAL—HELPERS

A. Introduction to Underground

1. Checking on and off shift.
2. Lamp-cleaning, care and replacement.
3. Safety clothing—hat, boots, gloves, goggles.
4. Cage schedules—conduct on cage.
5. Smoking—not on cage or inside fire doors.
6. Shaft layout — number of shafts and locations.
7. Fire signal—what to do.
8. How to call the cage.
9. What to do in case of accident —always report injuries.
10. Drift and crosscut layouts.
11. Walking in crosscuts—safety bays.
12. Where and how to get tools and equipment.
13. Powder storage—safety rules.
14. Personal behavior.

All these points are explained by the supervisors and checked repeatedly until the new men know them thoroughly.

supervisors before it was printed.

The manual was divided into two parts. In the first, there were listed points every man had to know, regardless of the job he might eventually take in the mine. The second part described the principal steps and key points of basic jobs.

It might have been more economical to train each man specifically for some one job, such as machine helper, chute puller, etc. But Hollinger's practice is to train a man in several jobs, because one crew is responsible for drilling, blasting, mucking, backfilling, and timbering the stope. We feel it advantageous to give each crew member a broad training in the work of the crew as well as in the special job he does normally. Close observation enabled the instructors to tell at the end of two weeks what job it was that each man seemed best suited for.

We kept a record to show the progress of each individual. At the end of each shift, the instructor was required to check off the items covered that day. Instructors also had to grade each man once a week on his attitude, aptitude, initiative, effort, and safety consciousness. The instructors discussed these ratings individually with the men. These training records went along with the trainees when they went out of the training level into the producing part of the mine.

Hollinger realizes that no training program is any better than its instructors. Therefore a program of instructor training was offered to all line supervisors and to the skilled miners who served as instructors. This was the standard series of J. I. T. conferences developed during World War II. Unquestionably this program fulfilled its purpose.

Back to Normal

The rate of labor turnover decreased greatly in late 1948. Although there were fewer green miners to train, more mechanical equipment was being introduced and research was developing improved methods. This meant that a smaller work force was adequate to maintain production, but that some of the men would have to be re-trained and the skill of the whole force increased.

It was decided that the needed training could be done without maintaining the training level. Responsibility was thus returned to the line supervisors, for basic training as well as advanced.

Although the shift bosses could do much of the re-training made necessary by increased mechanization, there were some new methods that called for long and detailed instruction. There were other methods that would be used by specialist crews, of which a shift boss might have only one reporting to him. In the first case, the shift boss would not have the time for long instruction periods; in the second, it would not be worthwhile to train all the supervisors to instruct relatively few men. Therefore, assistance had to be provided from a central point.

Each production section in the mine now has a skilled miner who gives his full time to instructing crews in using new equipment or methods. When new methods are introduced, these instructors are trained first. They then pass the information along to the production sections.

For example, it has been necessary to train a greater number of crews to do special timber work in removing sills below timbered stopes. This is a long job, and no shift boss could spare the time needed for detailed instruction on how to do it. Yet it has been found necessary to run through the instruction several times before a new crew can be considered competent. That's where the special instructor comes in.

Another example lies in a recent decision to use igniter cord for blasting in raises. There are about 25 raise crews in the mine, each one working for a different shift boss. One way to train these crews to use the cord properly would be to train the 25 supervisors, or the 25 crews, probably both. This would be a formidable task for the Production Engineering Department, with its limited staff.

Actually, the Department simply trained six instructors, who passed along the instruction to the raise crews, and the shift bosses, in their respective sections.

Does It Pay?

Back when the training level was in operation, some attempts were made to evaluate the success of the training program and to estimate its cost in dollars. They were inconclusive because of the way the training programs are fitted into regular production.

However, a kind of evaluation is always being carried on in the shape of questionnaires or conferences to get the opinions of line supervisors on the successes or shortcomings of the program. Such an evaluation is rough, but it does provide a reasonably satisfactory measure of the work.

In any event, the management considers the present training program well worthwhile as an investment in increased output at lower cost. Such evaluations as have been made have served to confirm this view. The only changes indicated have been those that are required in order to keep the program in line with changing conditions in the mine.

Better Mining Through Better Management

"Safe Production," Not Just "Safety" is the Target

Three "E's" of safety, Engineering, Education and Enforcement are the basis for this program that cut accident frequency almost 50%.

JOHN COOKE

Accident Prevention Supervisor

PRODUCTION IS THE HOLLINGER objective. The four phases of production are Safety, Quality, Quantity and Cost. All must be included in the supervisor's thinking and planning. However, management provides plenty of assistance in these phases, and the Accident Prevention Section is the unit set up to work with him on safe production.

Each line supervisor is directly responsible for the prevention of accidents and for developing a continuous safety program. As the management man closest to the workers, his aim is to make the men *want* to work safely.

Our supervisors have found that before their men want to work safely, they must have a feeling of security—recognition and praise—a feeling of belonging. This is where you find the incentive for safe working. Without it, we've found it impossible to develop a constructive attitude toward prevention of accidents.

Since the supervisor's time for his accident prevention program is limited, the Accident Prevention Section helps him by advising where he can spend that time most profitably. Why should he spend his time getting men to wear gloves when the possibility of injury to hands is small, while his men don't wear goggles and eye injuries are strong possibilities?

As a basis for their advice, the Section analyzes information from accident reports and job inspections. All accidents, regardless of degree of injury are investigated by the immediate supervisor. He describes the accident and its contingencies fully in a report. Analysis of these reports reveal recurrent causes, whether they be people, machines, work methods or mine conditions. When the problem is determined, the Section and supervisor make a joint decision on the best method of solving it.

Daily inspection of work places, men and machines is done by the supervisor to check if his planning has been sound. He can't undo what is done, but he can replan. The Accident Prevention Section inspects only when it is asked to do so by the supervisor. As a specialist in this field and with the background of previous reports, the Section man can materially aid the supervisor in his safety program. All information gathered goes to that supervisor and no one else. Any disagreement on procedures or recommendations is taken to the next level of supervision by both supervisor and the Section.

Mine captains hold a safety meeting every four-week period for all supervisors. This is attended by a member of the Accident Prevention Section. All accidents are completely reviewed and discussed and decisions are reached with the aid of the Accident Prevention Section on what the immediate problems are and how they can be solved. Execution of plans is the responsibility of the supervisor.

Further duties of the Accident Prevention Section require that it review new methods and equipment at the mine and plant from an accident prevention point of view. It keeps abreast of what is happening at other companies by maintaining contact with all the safety representatives of the various mines in the district. It watches for developments throughout all industry through its membership in the National Safety Council and various publications to which it subscribes.

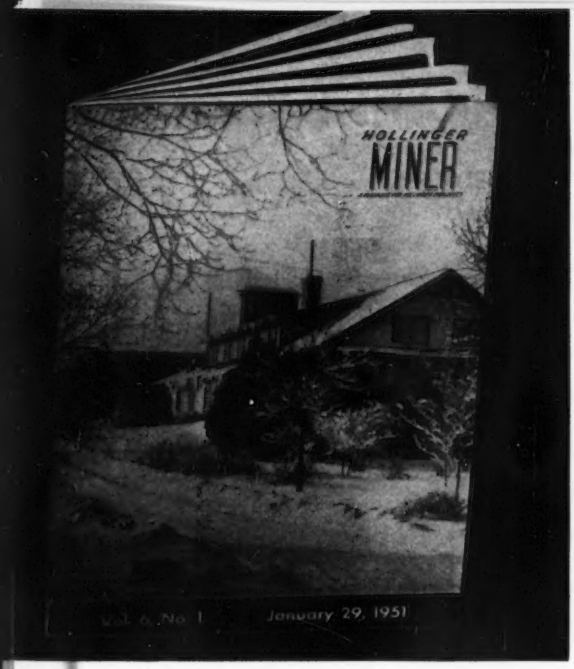
Education is the responsibility of the Section as well as the supervisor. New employees are given counselling in safety, provided with goggles and assisted in obtaining necessary protective equipment. The Section conducts 6 one-hour first aid and accident prevention classes with all new mine employees and refresher courses are held regularly. It also maintains a steady supply of educational material on the notice boards.

Using Movies

Movies are used as much as possible to help put safety across. They have proved quite popular in the Mine Department when shown in the waiting room to the men ready to go on shift.

Other accident prevention efforts are employee safety committees in some departments which meet every four weeks with their supervisors and the Accident Prevention Section to review accidents, and six complete 6-man Mine Rescue Teams, fully trained for any emergency.

Underlying principles of all these measures to solve our safety problem are the three "E's" of safety; Engineering, Education, and Enforcement.



What Good Communications Can Do

NORMAN GREENE
Supervisor of Publications

A top notch employee publication is only one phase of Hollinger's effective communications program

BECAUSE AN INFORMED BODY of employees is essential to the success of the entire Hollinger program good communications are of prime importance. The flow of information upward to top management to aid them in shaping company policy is as important as the flow from the top to employees.

For maximum effectiveness, the communications program should be designed for specific conditions under which the mine or plant operates. At Hollinger, these factors are remoteness (Timmins is 500 rail miles from the nearest center of industry) and the mixed origin of the population (44% British extraction, 38% French-Canadians).

Significant too, is the character of the industry. Unlike a manufacturing plant, Hollinger employees are scattered throughout 38 working levels (deepest: 5,450 ft.) with more than 300 miles of underground railway.

Hollinger believes that the key man of the communications program is the supervisor. All media are designed to keep him as fully informed as possible. If he doesn't have the information his men want, he should know where he can find it.

The Hollinger Procedure Manual not only keeps supervisors informed of company policies and procedures, but is a practical way of encouraging their participation in shaping policy. Because uniformity in handling company business in different parts of the organization is essential in maintaining good relations, the senior staff decided upon the use of written procedures. Frequently the need for a procedure is pointed by first line supervisors. It is referred to the Industrial Relations Division, which investigates and submits a proposed procedure. This procedure is then discussed by senior staff, and a tentative draft developed. Copies go to all supervisors who are encouraged to express their opinions and make suggestions. With this additional information the senior staff again considers the matter. The final draft is prepared and submitted to the general manager. When approved, copies are distributed to all supervisors for inclusion in the manuals.

The Management Newsletter, issued as needed, is first-hand information to supervisors that bears upon their supervisory activities but deals with subjects ordinarily removed from their direct knowledge. These subjects include management-union negotiations, and progress reports of meetings held with employe representatives; effects of legislation on the company and the industry; developments in any field that may affect relationships between supervisors and employees.

Through Management Newsletters, the General Manager can get accurate, authentic information to all supervision quickly, and, being printed, it is on record and can be referred to at any time. However, these Newsletters sometimes deal with complex problems and offer supervision no opportunity to ask direct questions. A second disadvantage is their expense. To make them accurate, a tremendous amount of time is required of members of senior staff in their preparation. Nevertheless they are proving to be a major channel of communication. Management Newsletter is now anticipated as an expression of the company's

office position by all supervisors.

"Supervision" goes monthly to all members of the supervisory staff. Also of modest format and produced entirely in the company offices *Supervision* is mainly a report of the past month's activities and proposed future changes. Material includes production reports, safety records, absenteeism, labor turnover and national, industrial and labor developments. It also carries articles of interest to supervisory personnel, such as reports of conventions that have been attended by staff members, personal news of supervisors, including thumbnail sketches, promotions, appointments, retirements, etc.

Supervisory meetings round out a program of communication for supervisors. Usually held within a particular department or division, some of these meetings are periodic, others are called as desired. All levels of supervision are included to discuss plans and express opinions on varied subjects.

Visits to other companies, special meetings addressed by visiting officials and representatives, and the free sharing of information with the personnel of other mining and associated organizations contribute to making Hollinger's supervisors as well informed a group as may be found anywhere in industry.

As much information as possible is passed on to the employees by the supervisors, but some is presented directly.

One of the chief means of direct communications with employees is the employee magazine, the "Hollinger Miner." Published every four weeks, the Miner presents information on many subjects, including company plans and policies, departmental activities, safety news and articles, credit stories for outstanding services and achievements, financial statements and annual reports of the company, and personal news items. Appreciating the value of the Miner, supervisors help Department Editors or Correspondents, with tips for articles, stories and pictures.

The Hollinger Miner is distributed at the gatehouses. The problem of discards is almost unknown, and the number of copies found along the half-mile walk from the gatehouse to the town is less than one per issue.

Additional copies of each issue are available to employees. A recent survey indicated that more than 40% of employees send copies to friends and relatives. Many keep a permanent file.

Significance of not mailing to the employee's home was minimized by the same survey, since 96% of the employees indicated that they take their copies home —the same number said that they read the magazine regularly.

In addition to employees, a mailing list of several hundred names is maintained including former employees, leading business and professional men of the community, schools, libraries, other companies and interested parties in other communities.

The company's policy of sharing information makes it possible to maintain a high interest rating. Discussing openly all problems and decisions which affect the company, employees and community, in the employees' publication, gives it an authoritative note and keeps employees well informed.

Employee Meetings. While the Hollinger Miner and bulletin boards keep employees acquainted with matters of general interest, special developments often require additional attention. In such cases special meetings of his own men are called by each supervisor.

At these meetings, a supervisor, familiar with the subject, explains all pertinent points and answers any questions frankly and fully.

This method of sharing information was used when establishing new incentive rates. Each supervisor when familiar with the new rates, called a meeting of his key men and explained the new rates. Staff members helped to answer questions. These questions were tabulated to serve as a guide in preparing material for further meetings.

After several days to permit key men to discuss the new rates with other workmen, additional meetings were called for all employees. Guided by previous meetings, the matter was again fully discussed. Additional questions were asked, most of which provided opportunities to further explain specific points to observe the reactions of the men.

Result of this effort was that, while the new rates were accepted with some reservations at the time, workmen generally felt that the change was necessary and desirable. Close follow-ups permitted further discussion and explanation until full acceptance was achieved.

Evening classes are a unique feature of Hollinger's communications program, that has been watched with keen interest by industrial leaders. Now in its fourth year, this program has made possible a two-way flow of information exceeding even the greatest expectations and has resulted in a much wider knowledge and understanding of problems that confront both management and labor today.

When Business and Industrial Leadership, the first evening course was offered to Hollinger employees in 1947, the response was so great that the course had to be divided into two sections. The course consisted of twenty meetings, two hours long, attended by the men on their own time. Two meetings were held each week through the winter, with each group attending on alternate weeks. In this way men on shift work could attend all meetings.

The first hour of each meeting, a company representative discussed the subject, while the second hour was a question period. Each meeting was conducted by a different chairman.

When the course ended, the general manager presented certificates to the class at a dinner meeting to which their wives and the speakers and chairmen were invited.

Success of the first course created a demand for another, so that a Civics Course started the next year. This course, restricted to employees who hold certificates for the Leadership Course, includes visits to local business establishments, newspaper plants, radio stations, municipal council meetings and other key points in the community.

This year another course has been added in Personal Development. On an experimental basis, the program features coference-type discussions. Led by members of the supervisory staff with formal training in conference leadership, the group develop their own subject matter and conclusions. Topics include "What Is Expected of a Leader", "What Does a Leader Expect in His Fellows" and "The Qualities of Good Leadership."

With the continued expansion of the series of evening classes Hollinger will help bring about a greater appreciation of the things that contribute to our way of life, and at the same time provide positive leadership in developing mutual understanding between Labor and Management.

Better Mining Through Better Management

Public Relations Can Pay Off Too!

NORMAN GREENE, Supervisor of Publications

WHILE PUBLIC RELATIONS are largely determined by direct contacts between company personnel and the community, a formal public relations program can do much to foster good will.

Many people base their opinions of Hollinger on what they read in publications. Such printed material should therefore reflect the company and its policies and practices as accurately as possible.

To do this, members of the press require more than a passing acquaintance with Hollinger so we take every opportunity to further the press' knowledge of the company.

1. Personal acquaintanceships between the press and company personnel is encouraged.
2. Company officials are available to discuss company affairs.
3. Periodically the local press is invited to tour the plant.
4. News releases of public interest cover special activities.
5. Every assistance is given in gathering data for technical articles. Photographers can visit the workings to secure their own pictures, or they are supplied from our files.

No attempt is made to withhold information. While events may occasionally result in unfavorable publicity, experience has shown that as long as the company operates in the interests of the majority under policies that are fair and just, the balance of publicity will reflect it in a creditable light.

The Community

In bringing about a better understanding and acceptance of the company within the community, the role of the employee cannot be overemphasized, but supplementary work can be effective, too.

Plant visits are a good way to acquaint people with the company. Employees are encouraged to bring their families, relatives and friends on personally-conducted tours. Other tours cover the entire surface plant three times a week, with guides to explain operations. Members of the technical staff accompany technical visitors.

We arrange visits to the refinery, where the gold and silver are refined and poured into $50,000 bars, and to the underground workings whenever possible. Special tours accommodate local and visiting groups, including schools, youth groups, official tours, and community organizations. Plans are now being developed to have local school teachers and health nurses visit underground and surface workings, and to meet with top supervisory personnel.

Company personnel are always available to speak at meetings of local organizations. Acquisition of a 16-mm. sound projector, making it possible for company representatives to show movies at schools, church groups, hospitals and other institutions are another indication of the company's interest in the people and activities of the community.

Outstanding in promoting community relations was the open house held last winter to mark the opening of a new mine change-house. We thought that families of employees would be interested in seeing the new accommodations and prepared preparations for 2,000 and 3,000 visitors on a Sunday afternoon.

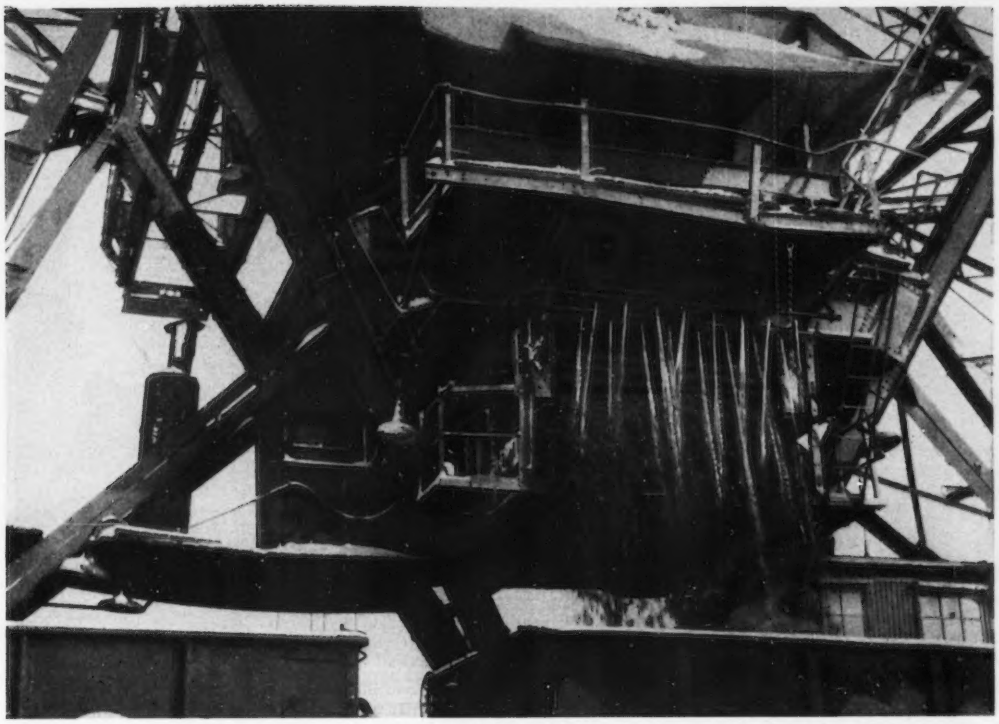
"THAT'S WHERE MY DADDY keeps his work clothes." Youngsters examine Hollinger dry at recent open house.

Mining and safety equipment, minerals, gold and silver, and moving pictures, and printed material were prepared for the visitors. Members of the supervisory staff were recruited as guides. Transportation and special accommodations, such as cloak checking rooms, were arranged. Top management was on hand to greet the visitors.

Despite temperatures between 20 and 30 deg. below zero, crowds gathered early. Three additional buses had to be procured. In all, an estimated 10,000 persons, some of whom traveled up to 100 miles, visited the building during the three-hour open house.

Other methods of encouraging the public to become better acquainted with the company are invitations to meetings of the Hollinger evening classes and other employee activities. Representatives of the Department of Mines participated in recent supervisory training courses, and representatives of other companies sat in as observers. Printed material, pictures, rock samples and other items requested by school children, hobbyists, collectors, and others are made available, the only exceptions being the requests for samples of gold and silver. Use of company facilities, such as the community park, conference rooms, recreation hall, library and others, all contribute toward better relations with the community.

If an organization has sound, fair policies and is operating in the best interest of the majority, the more people that become acquainted with the organization and these facts, the greater will be its number of friends.



FREEZEPROOFING CALCIUM CHLORIDE SOLUTION is being sprayed onto iron ore as it is being loaded from Lower Lake stockpile into railroad cars for shipment to the furnaces. A gallon per ton shipped is used.

What Freezeproofing Can Do To Simplify Winter Ore Unloading

FREEZEPROOFING IRON ORE with calcium chloride, to permit quick unloading of railroad cars in cold weather, made it possible for the Erie Railroad's subsidiary dock company at North Randall, Ohio, to ship about 177,000 tons in January, 1950, from its Lower Lake dock to the steel mills in Pennsylvania and Ohio—a record.

Normally the dock company ships about 75 60-70-ton cars daily. The dock will store 1,000,000 tons but took an extra 10,000 last year.

The ore comes from the Lake Superior ranges to the docks via ore boats during the shipping season, and is stored for rail transfer to mills in colder weather when the lake shipping season closes.

A clamshell moves the ore from the stockpile to the hopper; then the ore is dropped into waiting ore cars. During cold weather months, bottoms and sides of each car are first sprayed with freezeproofing solution.

Solution is then sprayed on each load of ore as it is dumped into the car. Two long solution pipes are mounted across and in front of the hopper on the car side. Outlets in the bottom of the pipes distribute the solution in a uniform spray on each load. One gallon is used per ton shipped.

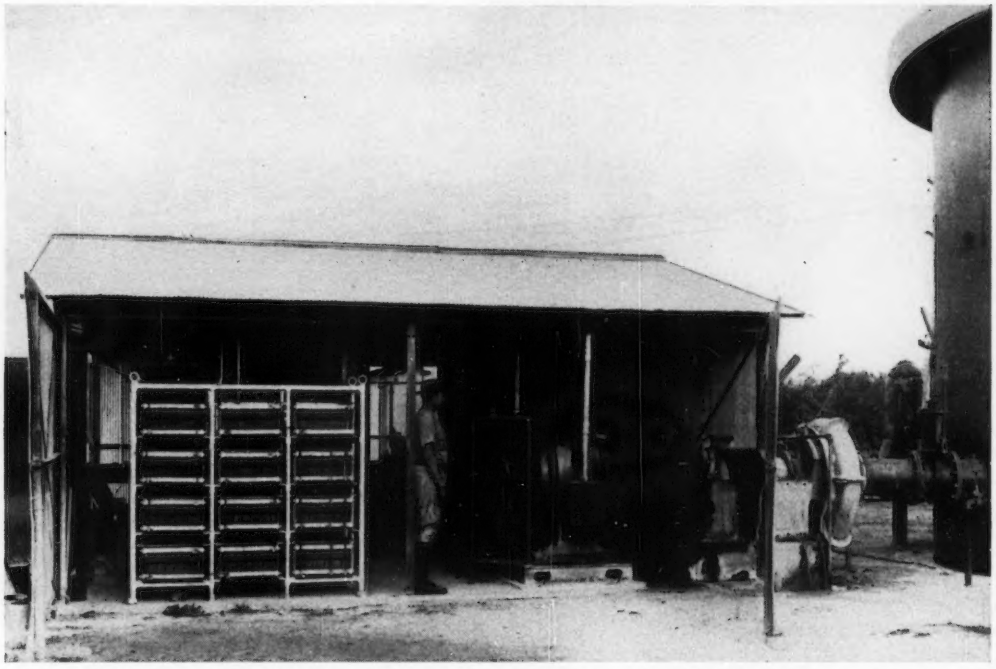
The solution is prepared in two vats having a total capacity of 4,250 gal. To make the solution, flake calcium chloride is added at the rate of 100 lb. for every 25 gal. of water in the vats. Compressed air is used to mix the contents.

At these vats, motor-driven pumps supply the pressure for pumping the freezeproofing solution through a large diameter reinforced rubber hose that runs from vats to hopper.

Freezeproofing iron ore shipments with calcium-chloride solution is not new. For almost 10 years, steel mills receiving cold weather shipments of ore from the ore docks at Conneaut, Ohio, have requested that they be freezeproofed.

Only recently a steel mill checked on possible advantages of shipping ore via rail from Minnesota to Pennsylvania during cold weather. Calcium chloride was used to freezeproof an experimental shipment of 135 cars from Minnesota docks in December, 1950.

The cars arrived at the mills in good condition and were readily unloaded. Since then these mills have received about 6,000 additional freezeproofed cars.



STARTING HERE, at Virginia-Carolina Chemical Corp.'s new Clear Springs, Fla., phosphate washer, plant tailing is pumped through 5 miles of 14-in. line to a flotation mill. Operator controls this initial 12-in. pump (250-hp. motor) manually. He has remote control over four booster pumps placed along pipeline. (See map at right.)

Phosphate Rock Pumped 5 Miles

How improved pumps and ingenious remote-control system combine

HUBERT L. PASCOE

Manager, Florida Department
Virginia-Carolina Chemical Corp.
Nichols, Florida

Matrix Pumping Old Practice in Pebble Field

The Florida land-pebble phosphate field yields in general two products, washer rock and concentrates. The washer rock, or pebble, usually ranges from 20-mesh to 2½-mesh and the concentrates range from 20-mesh to 200-mesh. However, in the early days before the introduction of flotation into the field, pebble was prepared over screens ranging from 14 to 20-mesh and the undersize or so-called washer debris, was stored in old worked-out pits, or areas provided for the purpose by some of the farsighted companies, for future treatment.

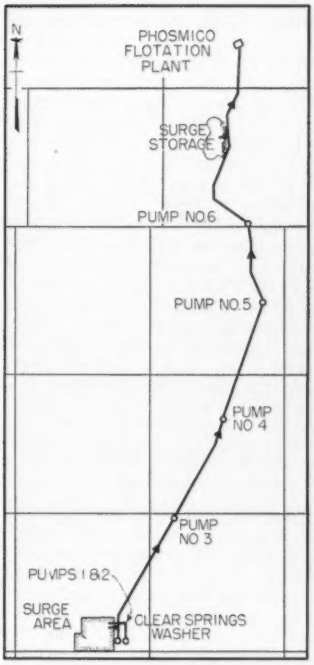
Ever since pumping of the phosphate-bearing matrix from the mining pits to the washer became universally accepted practice, washers have been so located on a tract of land as to restrict the pumping distance to a maximum of 2¼ to 2½ miles. Pumping over greater distances has not been considered practical nor economical.

Since the introduction of flotation[1] into the field and where the deposit contains fine fractions of rock of commercial value, flotation plants have been built adjoining the washers, and the washer waste or debris, after passing through the usual desliming and sizing processes, has been treated in them by flotation.

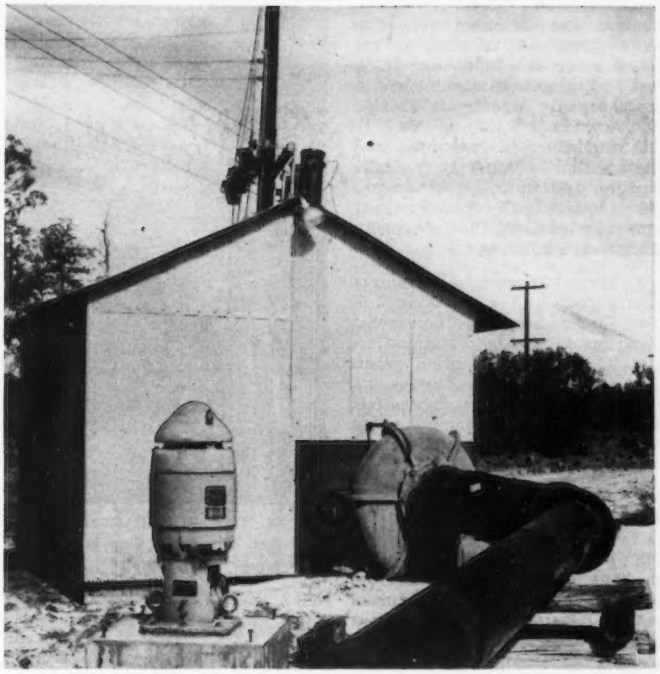
[1] The term "flotation" is used broadly to cover the beneficiation of the finer fractions of phosphate rock by cell flotation, concentrating tobles, belts, spirals, etc. To be treated satisfactorily by flotation, material must pass through a 20-mesh screen.

WHEN THE VIRGINIA - CAROLINA Chemical Corporation acquired the Phosphate Mining Co. in 1945, in the land-pebble phosphate field in Florida, it came into possession of a small flotation plant which the latter company had built at its Phosmico mine five years before to treat the debris from its mining operations there as well as the waste dumps that had accumulated in the vicinity in prior years.

After the phosphate deposits within the economical pumping range of the washer had been



PIPELINE, with booster pumps, successfully carries 150 dry tons per hour of minus 20-mesh rock at 13% solids.

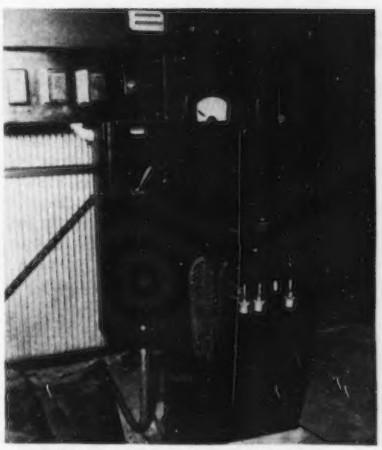


BOOSTER PUMP, typical of four used in 5-mile line, has 14-in. pipe connected to suction side with flexible coupling. Slip joint on discharge allows for pipeline expansion. Well-type turbine pump provides clean sealing water.

To Hold Down Transport Costs

to make possible economic long-distance pumping of fine ore.

worked out, the flotation plant continued to operate for several years on the old debris accumulations. When the exhaustion of these dumps became imminent in the spring of 1950, Virginia-Carolina was confronted with the problem of choosing between building a new flotation plant at another location, dismantling and moving the old plant there, or of supplying feed to it from a distance heretofore considered impractical. The company was then planning a new mine at Clear Springs, the washer of which would be approximately five miles from the site of the Phosmico flotation plant. The cost of transporting feed by rail from the new mining location to the Phosmico plant was investigated. Thorough comparative studies were made of the cost of building a new plant and dismantling and re-erecting this old Phosmico plant at the new mining



CONTROL PANEL in booster pump station. From here, a carrier-current transmitter informs operator of pump's condition. Pump drive (right) consists typically of 150-hp., 4,160-v motor.

location, and estimates were also made of the cost of pumping the debris nearly five miles, something that had never been done before in the phosphate industry in Florida or elsewhere.

A number of factors influenced the decision to build the five-mile pipeline and to transport washer debris hydraulically from the Clear Springs mine to the Phosmico plant. They were as follows:

1. Several Diamond-Alloy slurry pumps made by the Pettibone-Mulliken Co. had been tested in various departments of the Virginia-Carolina's Homeland flotation plant. Because of their high efficiency and resistance to abrasion, it was felt that, by their use, pumping five miles would be both practical and economical.

2. The electrical department, headed by R. A. Hardy, had perfected a system of remote control for pumps which permits starting, speeding up, slowing down and stopping all pumps from the initial pumping station by a single operator. No other labor is required except a maintenance man who inspects each pump once on each shift. The system had been in use for three years in the Corporation's pumping lines running from the mining pits to the washer.

3. An adequate and dependable supply of clear water for sealing purposes, it was found, could be obtained economically by drilling shallow wells at the individual pump locations. This in itself was a departure from the usual practice in the field. It had been customary to supply clear water under pressure from some centrally located deep well, usually drilled at the washer site, which well was relied upon to provide water for mining, washing, flotation and other purposes around the plant.

The Five-Mile Pipe Line

The flotation feed which is pumped to the Phosmico flotation plant, the distance pumped being 25,710 ft., is drawn from a tank by a 12-in. Pettibone-Mulliken pump which builds up approximately 45 to 50-psi. pressure in the line. A second 12-in. Pettibone-Mulliken pump in series takes the product from the first pump and builds the pressure up to 90 to 100 psi. The first lift pump is located 5,575 ft. from the initial pumping station and the three other booster pumps that follow are spaced 4,216,

ALONG THE ROUTE of the 14-in. pipe line. The power line is seen in background.

4,459 and 3,774 ft. apart, respectively. The last pumping station is located 7,686 ft. from the Phosmico plant where the slurry is elevated approximately 45 ft. and discharged into the feed storage bins. The variations in pump spacings are accounted for in part by elevation differences.

The 14-in. pipe is connected to the suction side of each pump with a flexible coupling. A slip joint is also provided near the discharge end of each pump to allow for expansion and contraction in the line. There is also a vertical standpipe in the 14-in. pipe near the discharge end of each pump, the purpose of which is to cushion air locks in the line. This standpipe is entirely enclosed and simply traps the air that may accumulate in the line.

Each pump requires approximately 50 gpm. of sealing water. This water for the first two series pumps in the five-mile pipeline is obtained from a deep well that serves the washing plant, at 60-psi. pressure. The pressure is raised to 110 psi. by the use of a Gardner-Denver centrifugal pump turning at 3,600 rpm. Sealing water is supplied to each booster pump by a well drilled at each pump location through a 12 to 16-stage turbine pump, driven at 3,450 rpm. by a 7.5 hp. motor. The wells are 4 in. in diameter and range from 100 ft. to 400 ft. in depth. The first pump is direct-connected to a 250-hp. wound-rotor motor with maximum speed of 720 rpm. (under ordinary operating conditions it turns at 600 rpm.). All pumps in the line are started, stopped and their speed is varied by an operator at the initial pumping station. A General Electric FK-142 panel is used for primary control of the No. 1 motor and four G.E. CR-2810 contactors, operated by a.c., are used for secondary controls. All pumps except No. 1 are belted to 585-rpm., 150-hp., squirrel-cage induction motors to give a pump speed of 600 rpm. These motors are started across-the-line with G.E. FK-142 oil circuit breaker panels. Pump No. 1 is under the constant supervision of the pumpline operator, so its control is manual. All other pumps are operated by remote control from the No. 1 pump house.

How Remote Control Is Handled

Remote control is accomplished by the use of Minneapolis-Honeywell Modutrol motors and step controllers. Basically, this is a 3-wire system but two copper conductors and a ground are used. No trouble has been experienced by using the ground for one conductor.

From each pump station a carrier-current transmitter keeps the operator informed of the pumps' operation.

Each station is equipped with a transfer switch to enable an operator to "take control" of that station, if for any reason it should become necessary.

The entire control system is interlocked and time-delayed in such a manner that, in the event of a complete power failure of short duration, all units will resume operation in proper sequence without the operator's attention.

One feature of the control circuit that deserves mention is the hold-out circuit on each slurry pump which assures an adequate flow of clear sealing water at 110 psi. through the pump packing glands.

In the starting sequence for each station, the sealing water pump is the first unit to operate. This furnishes water to the packing gland of the slurry pump through a Magnetrol flow alarm set at 30 gpm. The primary breaker that starts the pump motor can operate only if this rate of 30 gpm. is maintained through the flow alarm. If at any time the rate of flow falls below 30 gpm., the flow alarm opens the primary breaker, shutting down the pump and actuating the carrier-current control which notifies the pumpline operator at the No. 1 Station.

Slurry Pumped at 13% Solids

The pumping line was designed to transport 4,580 gpm. of slurry at about 13% solids. The solids consist of approximately 70% plus-200-mesh material, or 150 dry long tons of deslimed feed per hour. A velocity of 9.6 fps. is maintained in the line. Any one pump in the line with the exception of No. 1 may be shut down and the flow will continue at a slightly reduced rate. The line may be shut down fully loaded and operation resumed, whenever desired, by simply starting the motors from the No. 1 control house.

The second debris tank at the washer receives the overflow from the first tank and any surplus diverted to it from the washer launder. A 12-in. Pettibone-Mulliken Diamond-Alloy pump, turning at 600 rpm. and belted to a 150-hp., 1,200-rpm. wound-rotor motor, pumps the debris from this tank to the surge area near the washer. This motor is provided with an electrically-operated high-voltage oil circuit breaker, provision being made for both time delay and instantaneous over-current protection. Speed control is obtained by employing four electrically-operated contactors across the secondary resistance.

The automatic floatless liquid level control used at this tank is a rather unusual combination of equipments. This is made necessary by the solids present in the liquid and also the high turbulence which is present in the tank.

B. & W. floatless liquid level control relays are used. Standard B. & W. electrodes could not be used because of the conditions mentioned. Ten standard electrode holders with especially designed electrodes are located vertically in the side of the surge tank. Each of these electrodes is further protected by a 45° angle "roof" which consists of a 10-in. length of 2½-in. x 2½-in. angle-iron welded on end to the tank side and extending down at a 45° angle. These protect the electrodes against breakage due to a downward shift of material when a high concentration of solids is present.

The Modutrol Motor

The B. & W. relays in turn operate across the 135-ohm resistance circuit which forms one-half of the bridge circuit required to operate a Minneapolis-Honeywell "Modutrol" positioning control motor. This motor drives a mercury-tube step controller, which switches the high-voltage motor starter and four secondary contactors.

The primary contactor for the motor does not close until the liquid level of the tank is near the top, after which the secondary contactors close in sequence to bring the motor to full speed, time delay being provided by the inherent characteristics of the Modutrol positioning motor. As the liquid level of the tank falls, secondary contactors open to reduce the pump speed until a point is reached where the output and input of the tank are equal. If the input to the tank is variable, motor speed will rise or fall to maintain equilibrium in the system.

A change-over switch from automatic to manual is provided to insure continuous operation of the plant in case of any fault in the automatic floatless liquid level control system.

It can be said that the pumping line has been a success from the start. Tests show that there is little or no attrition of the phosphate rock in the line, and operating costs have been well within the estimates. At times, the pumping rate has far exceeded the rated capacity, with the result that the Phosmico flotation plant has been kept up to full capacity from the very beginning of pumping operations of the 5-mile pipeline and, in addition, a reserve supply of feed has been accumulated in the surge area adjacent to the Phosmico plant.

Basic Features of the Washer at Clear Springs

THE CLEAR SPRINGS WASHER, which was designed in the Florida engineering department of Virginia-Carolina's mining division under the able direction of K. C. Browne, department engineer, has several basic features that set it apart from other washers in the district. These are:

1. The elimination of elevators.

2. The use of mud-hogs or disintegrators that effectively reduce all oversize material to minus ¾ in. without producing an excess of fines. The patents to this equipment are owned by the Virginia-Carolina Chemical Corp.

3. The storage bin which, instead of being located over the loading track as is the customary practice in the field, is set back from the track and is equipped with a conveyor belt for loading the railroad cars.

The layout of the washer is illustrated in the adjacent diagrammatic plan and elevation of the structure. A description of the equipment mentioned in the following paragraphs accompanies the drawings:

The phosphate-bearing matrix is pumped from pit to washer feed box through a 14-in. pipeline. Slotted stationary screens remove much of the slime and minus-14-mesh material ahead of the double-deck vibrating screens which serve to scalp off the plus-⅞-in. rock and mud-balls and further dewater the minus-⅞-in. plus-14-mesh material before it enters the log washers. The plus-⅞-in. material from the upper deck of the screens goes to the disintegrators where it is mixed with the overflow water from the log washers, is reduced to minus ¾-in. and pumped back to the feed box.

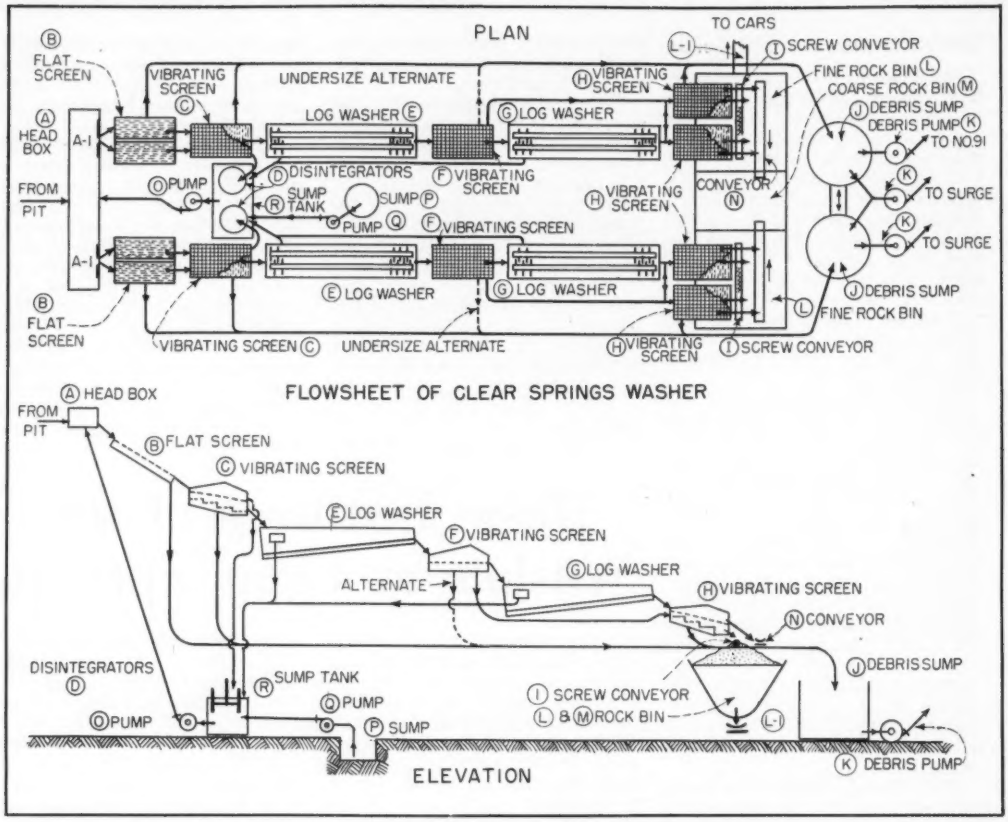
The log washers discharge onto a second set of vibrating screens which remove, for further scrubbing, the plus-5-mesh material. The minus-5-mesh from these screens flows by gravity to the lower vibrating screens for final screening and dewatering before it is deposited in the storage bins.

The plus-5-mesh material from the second vibrating screens, after passing through the log washers, is fed to the upper deck of the third set of vibrating screens which have 5-mesh screens for preparing a special coarse rock which is stored in the center bin. The lower deck of these screens is equipped with 14-mesh stainless-steel Tyrod No. 9707 for final screening of the washer rock.

Should it be found necessary at any time to pass all of the plus-14-mesh material from the No. 2 screens through the second log washers, this can be done by replacing the 5-mesh screen with a 14-mesh screen. The undersize then would be carried direct to the debris tanks.

A single 36-in. conveyor is used

Pumping Phosphate Rock Five Miles



CLEAR SPRINGS WASHER, with flowsheet shown in plan and elevation, is featured by absence of elevators, use of disintegrators to reduce oversize to —¾-in. without excessive sliming, and car loading with a conveyor belt.

LEGEND

A Full-width head or feed box. Receives material from pit, also from circulating pump "O". Equipped with four gates (A-1) which allow shutting off material from either side of washer or from either half of duplex flat screens "B" on either side of washer.

B Two 14-mesh "flat screens" at 33° slope, made of steel punched-plate screen over 8-in. deep sloping tub. Size on each side of washer approximately 9 ft. 2 in. wide by 19 ft. 6 in. long, with center divider on each side.

C Two Allis-Chalmers low head 6x12-ft. double-deck vibrating screens. Screen runs at 940 rpm. Top deck equipped with 7/8-in. square-mesh heavy-steel screen. Lower deck covered with 14-mesh, No. 9707 stainless steel Tyrod.

D Two V-C disintegrators. One for each side of washer with common feed chute arranged to split all or any part of feed to either machine. Disintegrators operate at 188 rpm. Driven by V-belt drive with shear pin by 125-hp. vertical ball-bearing T.E.F.C. 440-volt motors, each independent of the other.

E Two Georgia Iron Works (new design) 36-in. by 30-ft. double log washers, mounted on pivot point with screw jacks to allow adjustment of bottom slope from 1 in. to 2½ in. per foot. Each log has independent drive through "V" belts from 75-hp. motor.

F Two Allis-Chalmers standard single-deck low-head (horizontal deck) vibrating screens, 6x12 ft. This screen has a normal and an alternate usage. For normal flow, screens "F" are equipped with heavy steel Ton-Cap. For alternate flow, screens "F" are covered with stainless steel No. 9707 Tyrod.

G Two Georgia Iron Works (new design) log washers, identical with item "E" above.

H Four Allis-Chalmers low-head 6x12-ft. double-deck vibrating screens. Size of screens to suit requirements.

I Two 18-in. screw conveyors, approximately 20 ft. long each, without troughs, running approximately 30 rpm, 7½ hp. motor each.

J Two steel tanks or sumps for washer debris.

K Three debris pumps (slurry-type) Pettibone-Mulliken 12 MA 30-Diamond Alloy with 14-in. suction.

L Two fine-rock compartments of 200 long tons each. Slide gates in bottom operated manually with remote control from car-loading platform at track.

L-1 One 36-in. conveyor belt, approximately 120 ft. c. to c. driven by 25-hp. Gearmotor.

M Coarse rock bin, capacity 75 tons.

O One 8-in. Pettibone-Mulliken Diamond Alloy slurry pump with 75-hp. motor.

P One cleanup sump in concrete floor. Six-inch Pettibone-Mulliken Diamond Alloy slurry pump, with 20-hp. motor.

R One elevated steel sump tank.

to unload the bins into railroad cars. A unique chute gate designed in the engineering department by D. W. Newell, Sr., controls the flow of material onto the belt. The chute gates are operated by the carloader, who also starts and stops the conveyor belt and moves and spots the railroad cars under the loading chute with the aid of a car puller. Drainage from the bins and all spillage from the plant flows to a centrally located sump from which it is pumped to the disintegrator tub.

All minus-14-mesh material from the washer is collected in two tanks at the lower end of the washer. It flows by gravity in a single launder and is discharged into the tanks through down-spouts to provide agitation and thereby keep the coarse fractions from settling out in the tanks. A manually-operated splitter in the launder just ahead of the tanks controls the quantity of material that each tank receives. The tanks are joined together near the top with an overflow pipe. The debris from one of the tanks is pumped through a 14-in. I.D. special analysis spiral-weld pipe a distance of 25,710 ft. to the Phosmico flotation plant and the debris from the second tank is pumped to a surge area adjacent to the washer.

Two Shifts

The washer operates 16 hours a day. Three men on each shift operate the washer and load the railroad cars.

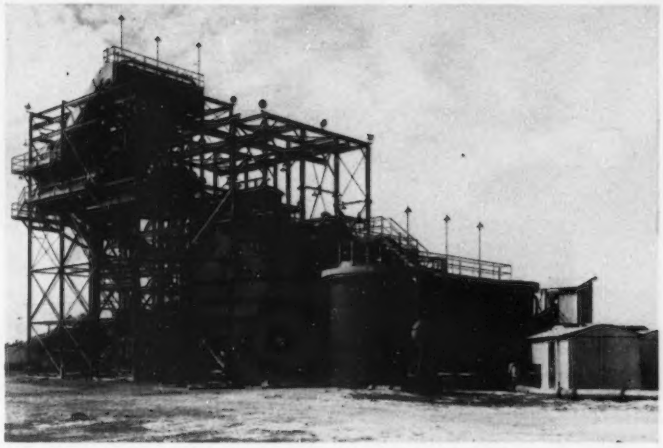
Washer Power: Power for the washer is furnished by a bank of three 500-kva. single-phase transformers, connected 4,160-volts wye on the high side and 460-volts delta on the low side. These transformers are located adjacent to the control house, the secondary bus being as short as possible. The secondary bus was fabricated on the job and consists of three ¼-in. x 6-in. copper bars carried in Micarta insulation, the assembly being housed in a No. 10 gage metal duct.

All starting equipment for the washer is located in a fire-proof control house. This equipment consists of Cutler-Hammer Unitrol sections, small motors (10-hp. and under) being controlled by fuse and contactor assemblies, arranged for across-the-line starting. Motors above 10 hp. are controlled by circuit-breaker and contactor assemblies, some being started across-the-line and others with reduced voltage, depending upon the particular application of the equipment.

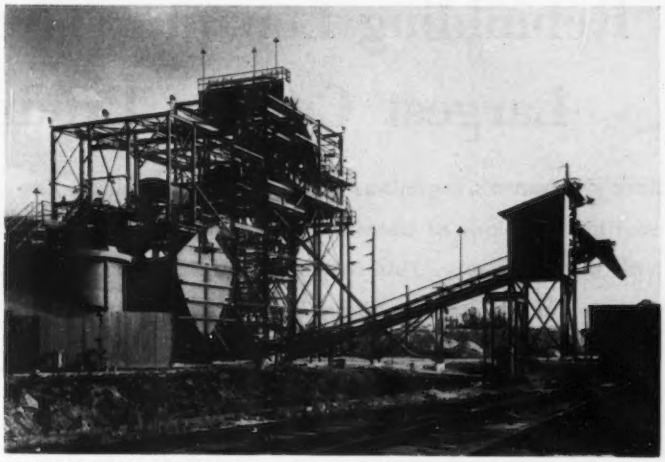
Individual conduits extend from the control house to each motor, each conduit carrying conductors for power and control. The push-button station for each motor is at a convenient location nearby.

All motors for the washer are totally enclosed, fan-cooled, and require no housing or covers.

One section of the Unitrol contains a 20-kva, 3-phase, 460- to 115-v. transformer with a 42-circuit, 20-amp. Thermotrip panel which furnishes lighting for the washer and office building. All lighting circuits are switched at this panel, no lighting switches being located in the washer.



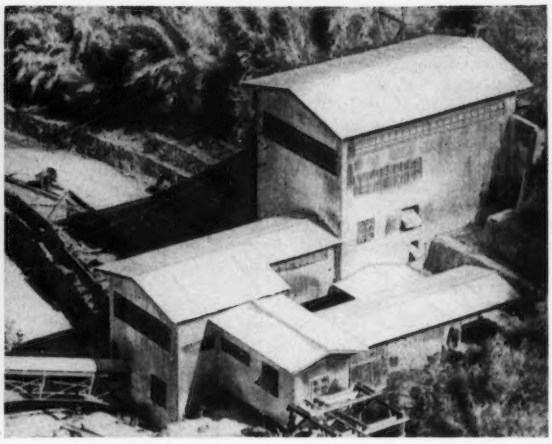
NO ELEVATORS in this new washer. From debris tanks (center) tailing enters 5-mile pipeline (right) leading to flotation mill for more treatment.



CAR-LOADING CONVEYOR is another unique feature of Clear Springs washer. This 36-in. belt replaces old-style bins over tracks, gives better control.

The author wishes to thank C. E. Heinrichs, vice president in charge of Virginia-Carolina's Phosphate Mining Division, with headquarters in Richmond, Virginia, for permission to prepare this article for publication. K. C. Browne, chief engineer of the Florida department, contributed the plan and elevation of the Clear Springs washer and the description of items of equipment and lines of flow. R. A. Hardy, chief electrician, supplied the technical data relating to electrical equipment. W. J. Menear contributed the map showing the 14-in. pipeline from Clear Springs to Phosmico and L. W. Harris supplied the interesting photographs.

BOMBED MILL, after Air Force finished with it.



NEW CRUSHING PLANT typifies best in modern design.

Rebuilding Lepanto, The Far East's Largest Copper Producer--Part II

Here's Lepanto's ingenious solution to a seemingly impossible problem of obtaining high grade concentrate with high recovery. This article completes the description of the venture, begun in last month's issue.

GEORGE MURRAY, Mine Superintendent
HUGH H. BEIN, Mill Superintendent
Lepanto Consolidated Mining Co., Mountain Province, P. I.

THE LEPANTO ORE cannot be termed a complex ore, but metallurgically speaking it is a difficult one. It is unusual in that the principal copper-bearing mineral is enargite ($3Cu_2S{\cdot}As_2S_5$), although about 10 to 15% of the total copper in the ore is contained in small amounts of chalcopyrite, covellite, chalcocite, tetrahedrite, and bornite. The ore averages 4 to 5% in both copper and iron.

The problems in treating the ore lie in the locked particles and in the distribution of the gold. Most of the mineral particles are freed at a medium grind, but enough remain locked at even a 400-mesh grind to make economic beneficiation difficult. Gold is found in the copper minerals, in one of the two varieties of pyrite the ore contains, and in the gangue. Because the copper-iron ratio of the ore is anything but constant, it becomes difficult to set optimum conditions for gold recovery. However, about 40% of the gold content of the ore (0.10 to 0.20 oz. per ton) can be recovered in a high-grade copper concentrate.

The gangue is highly siliceous, a hard cherty chalcedony, with some quartz, sericite, and barite.

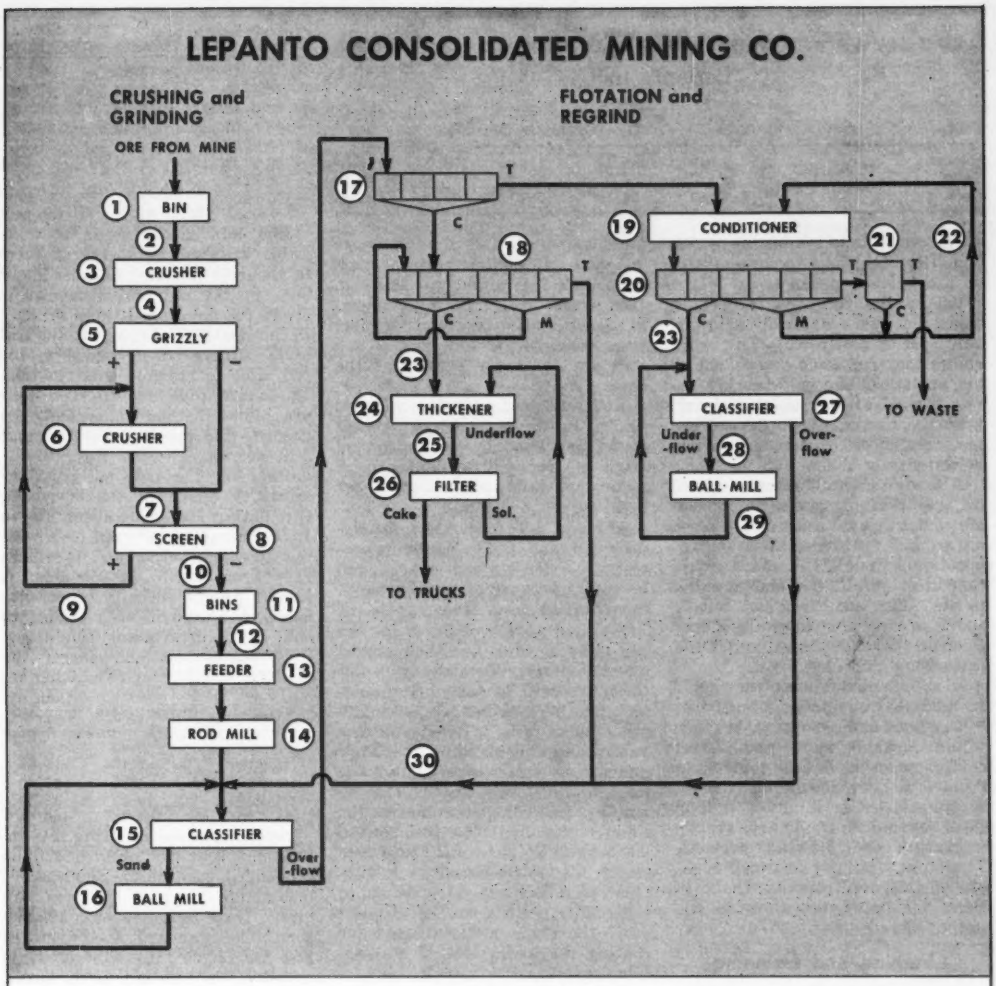
Grade of concentrate is quite important at Lepanto because of the long road haul and high ocean freight rates. Gold recovery is important, too, because the company can sell 75% of its gold output in the free market, the other 25% going to the Philippine Government at the $35 rate. To gain maximum grade, some gold-bearing pyrite would have to be sacrificed, and the problem here becomes one of balancing grade of concentrate and gold recovery.

Our testwork, which still goes on, has covered these possibilities:

1. A bulk float, carrying the copper and gold, which proved uneconomical because of low grade.
2. Cyaniding tailing from a selective (high-grade) copper float is unsuccessful because of the high copper content of the tailing.
3. The same objection rules out cyaniding the tailing of a high-grade selective float made on reground bulk concentrate.
4. Inhibiting pyrite to raise copper grade throws gold into the tailing.
5. We have tried, unsuccessfully, to find a way to depress copper, float a pyrite concentrate low enough in copper to be cyanided, then refloat the copper.

After trying the foregoing possibilities, and many others, we have adopted the following flowsheet:

1. Scalp off and clean a high-grade copper concentrate, using selective promoters.
2. Float a middling concentrate that is reground to 400 mesh.
3. Float and clean a concentrate from the reground product without



LEGEND

1. Coarse ore bin, 500-ton, 8-in. grizzly.
2. Chain feeder to 36-in. belt conveyor.
3. Blake-type jaw crusher, 24x36-in. driven by 2,300-v., 125-hp. motor; crusher speed, 184 rpm.; opening, 2½ to 3 in.
4. Belt conveyor, 24-in.
5. Live-roll grizzly, ½-in. openings.
6. Symons 4-ft. standard cone crusher, ½-in. discharge; driven by 440-v., 125-hp. motor; crusher speed, 484 rpm.
7. Three belt conveyors in series, 30-in.; lengths, 33-ft., 36-ft., and 22-ft.; speeds, 140, 145, and 173 ft. per min., respectively.
8. Symons rod-deck screen, 8x4-ft., ½-in. spacing, 5/16-in. oil-tempered, spring steel rods.
9. Belt conveyor, 24-in.
10. Three belt conveyors, 24-in.; one, 242 ft. on slope, 73-ft. vertical lift, tandem drive, 5 and 10-hp. motors; others, 55-ft. stationary, and 12-ft. movable, as shuttle conveyor.
11. Two fine ore storage bins; one 1,000-ton and one 700-ton.
12. Two Hardinge constant-weight feeders; two belt conveyors, 18-in.
13. Special rod mill feeders, Lepanto design, belt-type, 8-in. x 6-ft., 600 ft. per min., 2-hp., 440-v. motor.
14. Two Marcy rod mills, 5x12-ft., 125-hp. motors, 22 rpm., 3-in. rods.
15. Two 72-in. Akins classifiers, slope, 3½-in. per ft., 4 rpm.
16. Two Marcy grate-type ball mills, 8x6-ft., 22 rpm., 250-hp motors, direct-connected through Falk couplings, 2½-in. balls.
17. Primary flotation; two banks of four 56-in. Wemco-Fagergren cells each, rotor peripheral speed, 2,125 fpm.
18. Cleaner flotation: two banks of six 48-in. Massco-Fahrenwald cells each, peripheral speed, 1,690 fpm.
19. Two Denver conditioners, 6x6-ft.
20. Middlings flotation: two banks of six 56-in. Wemco-Fagergren cells.
21. Two No. 750 Denver unit cells, one in each flowline, used as scavengers.
22. Three Denver vertical sand pumps, 1½-in., one as stand-by.
23. Two Denver vertical sand pumps, 2-in.
24. Two thickeners: one Denver, 10x30-ft.; one Dorr, 12x35-ft.
25. Dorrco diaphragm pumps, 4-in. duplex.
26. Oliver drum filter, 11x18-ft.; two 14x8-in. Oliver vatuum pumps, one 1½-in. Hydroseal filtrate pump, barometric leg provided.
27. Denver hydroclassifier, 12-ft.; rake speed, 3.2 rpm.; overflow density, 15 to 20% solids.
28. Denver diaphragm pump, 3-in. simplex.
29. Marcy overflow-type ball mill, 5x8-ft., 100-hp. motor, 25 rpm., ball charge drawn from other mills.
30. Two Denver vertical sand pumps, 2-in.

Table I. Average metallurgical data for a recent month Lepanto mill.

Product	Tons	Assays Cu, %	Assays Au, oz.	Distribution, % Cu	Distribution, % Au
Heads	31,010	4.12	0.128	100.00	100.00
Tails	26,810	0.35	0.03	7.30	18.15
Conc.	4,200	28.19	0.754	92.70	81.85

using reagents to inhibit the pyrite.

4. Combine the two concentrates as the finished product.

All of the foregoing procedure takes place in a naturally acid circuit (pH of 5.5 to 6.0). Test work shows that for some reason not as yet explained, the gold-bearing pyrite floats better in an acid circuit than the barren pyrite does. Thus we obtain at least some pyrite rejection.

Although the acid circuit is hard on equipment, it keeps the insoluble content of the concentrate down to around 5%. Also, lime is expensive in the district and it would tend to inhibit the gold-bearing pyrite. Both soda ash and caustic soda are expensive, have a tendency to float too much insol, and make thickening difficult.

A satisfactory concentrate could be made by regrinding a bulk float concentrate and refloating, but this would demand more and larger equipment. Also, in bulk regrinding there is danger of sliming free enargite and losing it in the tailing. Such regrinding would also greatly aggravate the filtering problem. Therefore, until our testwork develops an improved practice, the flowsheet will be as shown on the preceding page.

Crushing and Grinding

Equipment used in the crushing plant is shown in the accompanying flowsheet and legend. Hardness and abrasiveness of the Lepanto ore shows up in rapid wear of the manganese steel bowl liners of the Symons cone. They last 20,000 to 30,000 tons; mantles crush about 20% more than that. The rod deck screen uses about 300 rods per month.

Present capacity of the crushing plant is about 70 tons per hour. We expect to increase it to 100 tons by certain improvements, notably in removing the fines from the feed to the cone crusher.

The grinding division has two identical sections, each with a capacity of 500 tons per day. Units are arranged as shown in the flowsheet. At one time a unit cell was placed in the grinding circuit but was later removed. Launders between rod and ball mill circuits are arranged so that either rod mill can feed either ball mill. This allows at least half-capacity operation, even when a rod mill and a ball mill are down for repairs at the same time.

Rod mill feed rate is controlled by a Hardinge constant weight feeder regulated by remote control from the rod mill switchboard. A meter on this board shows tons per hour entering the mill.

The rod mill feeder is a locally-designed and built "trunnion entrance feeder," which was found necessary because of rapid wear of conventional drum feeders.

We used wave-type liners for the rod mills at first, but they proved unsatisfactory. We now use a flat liner, recessed to take lifter bars, and find it satisfactory, although other types will be tried. We use rubber backing behind the liner plates because it helps protect the mill shell and because the slightly smaller mill diameter makes the liner plates fit more snugly and last longer. Because of the acid pulp water, we find it necessary to protect the mill shells, in addition to the rubber, with a coat of "Underseal" the same material used for coating the undersides of automobile fenders.

Owing to the higher wear at the feed end of the rod mill, and because the feed end bears the brunt of the copper water's attack, we cannot replace liners and lifter bars as complete sets. The feed-end one-third of the lifter bars go first, usually after 30,000 to 40,000 tons. The feed-end third of the liner plates are usually replaced when their second set of lifter bars is worn down. At this time, new lifter bars go in all through the rod mill. The remaining liner plates are replaced when the second set of feed-end liners is worn out. Thus, 1½ sets of liner plates and 2⅔ sets of lifter bars will treat about 120,000 tons of ore.

The rod mills run in open circuit as fine crushers. Their discharge varies somewhat, but the following screen analysis is typical:

Mesh	Weight, %	Cum. Weight, %
+ 10	12.16	
− 10+ 20	32.62	44.78
− 20+ 48	21.00	65.78
− 48+ 65	4.20	69.98
− 65+ 80	2.19	72.17
− 80+100	2.48	74.65
−100+150	2.94	77.59
−150+200	2.77	80.36
−200	19.64	100.00

Rod mill discharge is at 80% solids. It is diluted in the launders to about 60% solids. Because about 30% of the rod mill discharge is ready for flotation, it goes directly to the classifiers, bypassing the ball mills. Minerec 27 is added to the rod mills to promote this fraction. Three-inch high carbon steel rods are added to the mills daily as needed. Rod consumption is about 2 lb. per ton.

Data on the ball mill-classifier circuit is given in the flowsheet. Circulating load runs about 2½ to 1. Depending on the type of ore being treated, classifier overflows vary from 30 to 35% solids. A Massco-Adams density controller has been placed in each circuit to hold optimum grinding conditions. A typical screen analysis of the classifier overflow at 35% solids is:

Mesh	Weight, %	Cum. Weight, %
−80	8.40	
− 80+100	7.15	15.55
−100+150	9.65	25.20
−150+200	10.05	35.25
−200	64.75	100.00

Ball consumption, using 2½-in. balls, is 2.2 lb. per ton of ore. Balls are added each shift. Semi-pocket manganese steel shell liners are used. They grind about 100,000 tons. The standard Marcy grates last for 160,00 tons Minerec 27 is added to the ball mill scoop boxes.

Flotation

Arrangement of the various flotation cells is shown in the flowsheet. The Fagergren cells have been installed only recently, but they have cut reagent consumption appreciably. They also have produced a little higher grade of concentrate, because it is not necessary to over-promote to get a good tailing. This is true of their use in the middlings circuit, where we have done much experimenting with reagents. Best results have been obtained so far with Reagent 404 and Aerofloat 25 added to the conditioner. We also add a little Aerofloat near the tail end of the middlings circuit.

Total frother consumption is rather high because of the acid cir-

cuit. It runs about 0.15 lb. per ton. Promoter consumption runs about 0.10 lb. per ton.

Our 1½-in. Denver vertical pumps are set up as a battery of three, one for each circuit and one stand-by. They are fed in a novel manner by use of a triple-divided launder. Either circuit can be thrown into the stand-by pump by merely pulling out a small gate. Any overflow from these pumps goes into a clean-up sump.

The present operating crew is made up entirely of men who built the mill and put in its machinery. The mill has its own repair crew and bull gang. Any replacements of the operating crew, or any increase of operating personnel will come from these crews.

Concentrate trucks carry 7 metric tons, wet, on the 160-km. trip to Poro, the port of San Fernando, La Union. The narrow roads and the sharp turns require use of smaller trucks than ordinarily would be used.

At Poro, the trucks are weighed once more and dumped in the storage area. A portable, inclined conveyor stacks concentrates to await arrival of the ship that will carry them to the United States. Present storage holds 5,000 tons, but an increase is planned. Shipments usually run about 3,000 tons.

Power Supply

Lepanto's power is supplied by five 600-kw., 2,400-v. G. E. generators, each driven by a Worthington 800-hp. diesel engine. Four engines can carry the load, so there is always a stand-by engine and generator. Also available as a stand-by is a 250-kw. G. E. generator driven by a 400-hp. Ruston engine.

Because of the friable nature of enargite and its tendency to slime, filtration is a serious problem. This is especially true when the regrind division is operating and there is no coarse pyrite to help filtration. Cake moisture content varies from 9 to 13%, depending on the feed.

We have experimented with depth of submergence, drum speed, pulp consistency, and various mechanical appliances, all aimed at lower moisture content. A mechanical "slapper" mounted over the drum has given the best results, removing from ¾ to 1% of the cake moisture.

Crushing plant, mill, and filter buildings are of steel construction with aluminum siding and aluminum or corrugated iron roofs. Windows are of plexiglass. Lighting is by 220-v. fluorescent lamps.

The present operating crew is a 250-kw. G. E. generator driven by a 400-hp. Ruston engine.

Service has been exceptionally steady and reliable, without the frequent interruptions so often marring operations in remote areas. Fuel oil is an expensive item, and much study is given to cutting down its consumption. We use about 170 grams per hp. Power costs average about 2.1c. per kwh. with fuel oil averaging 18c. a gallon, delivered at the mine. Total oil storage capacity is close to 226,000 gal.

Air for the mine is supplied by two 23x14x14 Worthington compressors, each driven by a 300-hp. synchronous motor; one Gardner-Denver 19x11x12 compressor, driven by a 175-hp. motor; one G-D 17x10½x12 compressor with 150-hp. motor; one I-R Imperial XCB compressor driven by a 125-hp. motor, all motors synchronous. Total air available is about 5,400 cfm., but it is never all used. A 10-in. line about 1,200 ft. long delivers air to the mine. Air pressure at the power house is from 90 to 100 lb., with a 5-lb. drop to the mine portal.

Despite inadequate housing, the machine shop has turned out a tremendous amount of work for all departments since the rehabilitation work began. The shop includes: six lathes (largest swings pieces up to 4-ft. diam.), three shapers, a miller, three drill presses, 6-in. pipe threading machine, a shear, a hydraulic press with 9½-in. ram, welding machines, grinders, and a power hacksaw. Shop crews were responsible for most of the steel erection for the other buildings. For example, many of the welded steel roof trusses were built in the shop.

The company also maintains a completely-equipped electrical shop, a garage for servicing trucks and cars, and woodworking and paint shops.

Engineering

The engineering office is one of the largest non-operating departments of the company. The extensive rehabilitation work of the last three years has put a special burden on the construction section. In addition to doing all necessary surveying, mapping, drafting, and design, the engineering department has charge of sampling and assaying. The chief engineer is also the geologist, and works with the mine superintendent in laying out all exploration and development work.

The assay office is modern and efficient. It performs about 3,500 determinations a month. Daily routine assays are made for copper, gold, silver, iron, and insol. Monthly composite samples are run for arsenic and sulphur.

The Lepanto camp is one of the model mining camps in the Islands. Housing for the 1,800 persons living within the camp area is still being advanced although it is already superior to that at most camps. The company believes that only a healthy and happy workman is an efficient workman, and it proceeds on that basis.

Labor Relations

The company's postwar policy has been to operate with a minimum of foreign staff personnel. All positions below department heads, except for the mine, where the assistant superintendent is a foreigner, are held by Filipinos. The company carries on a training program, and an efficient and responsible staff of Filipino supervisory personnel is being built up. Results certainly justify the policy.

Labor comes chiefly from Mountain Province, but most of the Islands' provinces are represented. The average worker has been found to be adaptable, intelligent, and willing to give an honest day's work.

Production bonuses are offered in both mine and mill. Safety bonuses, given to certain classes of supervisory personnel, have shown important results in reduction of accidents.

The workmen, although not compelled to do so, may join a union, which elects its own officers and runs its own affairs. Its committee meets with management once a month, after the regular meeting to discuss grievances or other requests. The procedure is a living example of true collective bargaining in the democratic sense. Although a contract exists between the company and the union, which sets forth wage rates, the company recently voluntarily gave a general wage increase of 10%. This was done to pass along to the employees some of the savings incident to the recent doubling of the mine's production.

The authors wish to thank E. A. Perkins, president of Lepanto, and the board of directors, especially V. E. Lednicky and M. R. Arick, for the opportunity of preparing this article. C. B. Foster, general superintendent, has been especially helpful by offering many suggestions and constructive criticism.

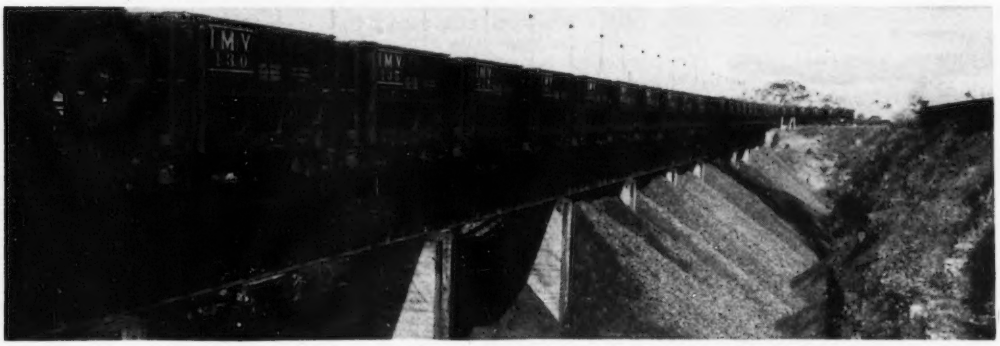
Venezuela's Iron Ore Now Reaching U. S. Furnaces

Here's how Bethlehem's El Pao ore is handled before it arrives at Sparrows Point

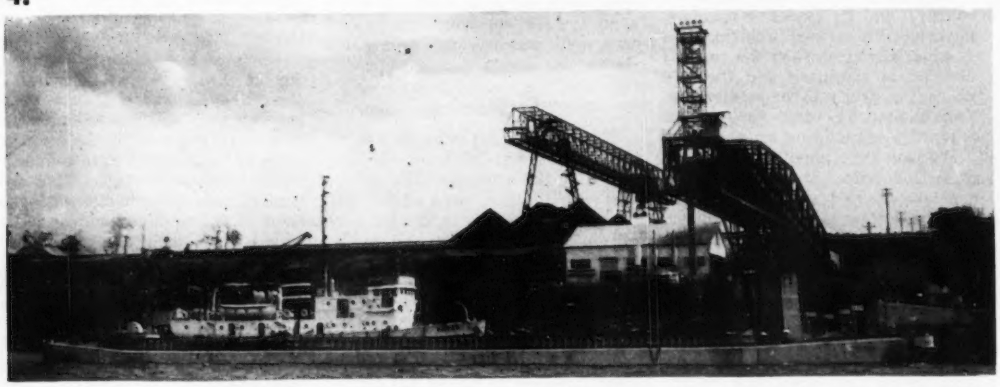
Photographs by courtesy of Bethlehem Steel Co.

Expecting to ship 1 million tons in 1951 and to schedule 3 million when operations are in full swing, with possible increase to 5 million later without material changes in layout and equipment, Bethlehem Steel Co. has equipped its El Pao mine for operation as follows:

1. GROUND IS BROKEN by shooting 9-in. holes 40 ft. and more deep with 60% gelatin dynamite and detonating fuse. Here an electric churn drill is at work, with two air-driven wagon drills for secondary breaking.



4. ORE TRAIN is unloaded at Palua on Orinoco, discharging into bin of 27,500 tons live-storage capacity.



5. BARGES AND OTHER CRAFT are loaded by conveyor system ending in structure overhanging river and delivering directly to vessels moored below. Water level of Orinoco varies nearly 43 ft. at Palua, depending on the season. This makes it impracticable to load cargoes from an ordinary wharf structure.

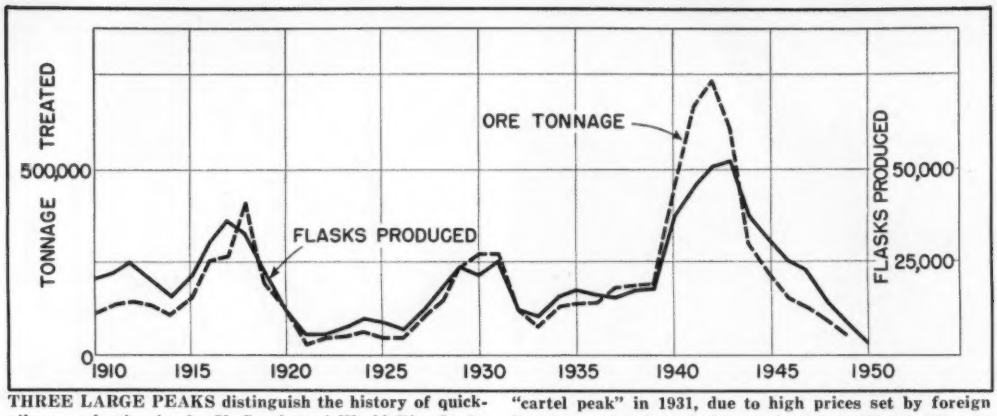
2. FOUR 4-CU. YD. ELECTRIC SHOVELS, such as this, load ore broken by blasting into trucks. As mined and shipped, ore is hard, massive hematite, 63-66% in iron, in deposit 2,600 ft. long, 1,700 ft. wide and up to 40 ft. thick.

3. TEN 30-TON HEAVY-DUTY SIDE-DUMP TRUCKS serve the shovels. Broken ore is delivered to primary jaw crusher, which breaks to 6 in., with further reduction to 2½-in. furnace size in secondary gyratory crushers.

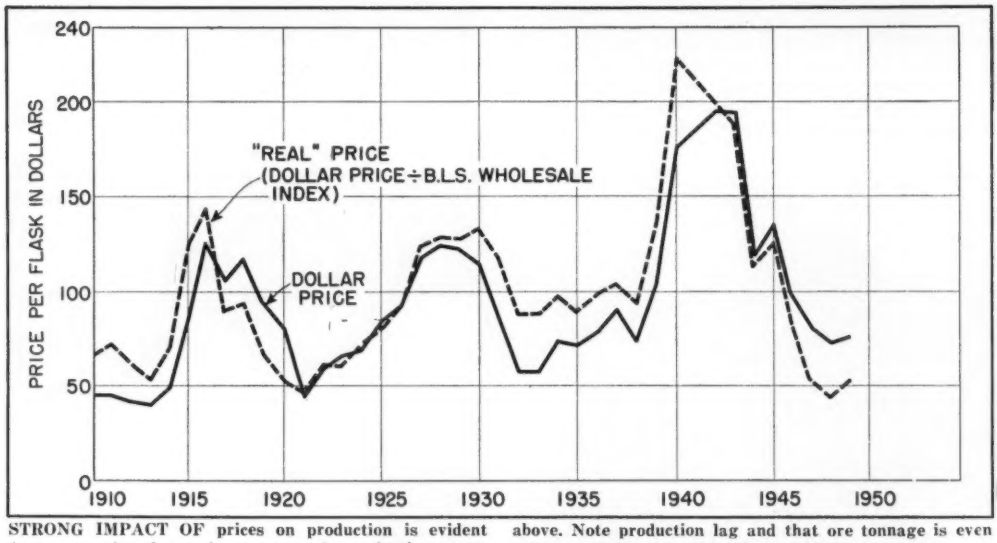
6. UNLOADING AT PUERTO DE HIERRO is done by placing barges end to end along 660-ft. pier and removing ore with three traveling towers having 8-ton grab buckets. Latter deliver to 48-in. belt which takes ore to storage pile on shore. Towers have combined capacity of 1,200 tph.

7. STOCKING ORE AT TRANSFER STATION, Puerto de Hierro, is done by delivering ore from each unloading tower (above) on pier to conveyor running over trestle. This discharges onto 80,000-ton stockpile via traveling boom tripper, here seen in center. From here 26,000-ton seag-going carriers are loaded.

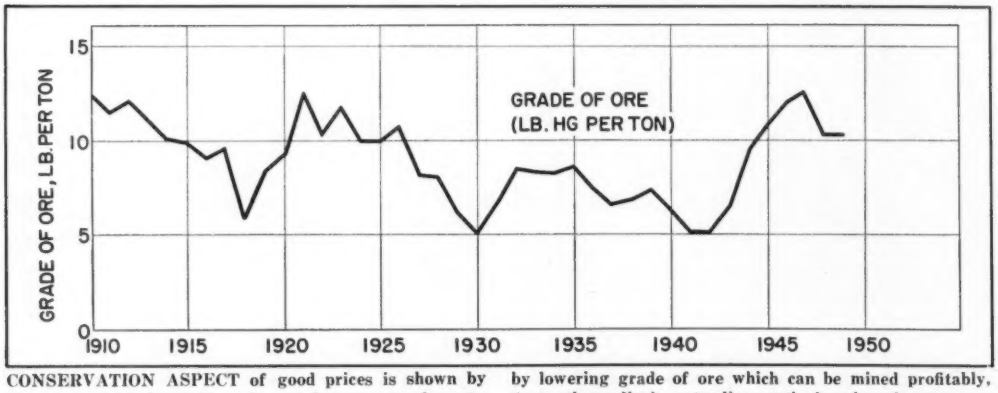
Forty Years of Quicksilver History



THREE LARGE PEAKS distinguish the history of quicksilver production in the U. S.: that of World War I; the "cartel peak" in 1931, due to high prices set by foreign interests; and the all-time peak due to World War II.



STRONG IMPACT OF prices on production is evident from comparing these price curves to the production curves above. Note production lag and that ore tonnage is even more responsive to prices than quicksilver output.



CONSERVATION ASPECT of good prices is shown by extent to which favorable prices make ore out of waste, by lowering grade of ore which can be mined profitably, (note three dips), extending nation's mineral resources.

Guaranteed Price Will Revive Domestic Quicksilver Mining

This article is about quicksilver, but as a lesson in fundamental mining economics, it is of universal interest to our readers. It shows clearly the importance of long-term expectancy of adequate prices in furthering new ventures, and the time and investments necessary to produce results.

C. N. SCHUETTE
Mining Engineer
San Francisco, California

LOOKING BACK AT 1950, we see that the business of quicksilver mining was at an all-time low. There were many prospects, many potential mines, ore reserves in old mines, good tools with which to mine, modern reduction plants, everything that was needed for the industry except an adequate incentive to go to work.

And the industry is still dormant. This is of no particular concern to anyone except the operators as long as we can obtain quicksilver elsewhere. In times of peace we can, but in times of war, quicksilver is an essential metal. In both World Wars I and II the domestic production of quicksilver just covered our needs. The two war production peaks shown herewith illustrate the expanded requirements of war time. It is obvious that this need has been much greater in successive wars.

If a third world war should break out, foreign sources of quicksilver in Italy and Spain could be cut off from us by submarines sinking the ships trying to bring it to us, by bombing of the mines and plants that produce it (these are very few in number and their location is well-known), by 5th-column sabotage, by actual communist revolution in Italy and Spain, or by communist invasion of these countries. As insurance against such possibilities, we have a stockpile of quicksilver based on estimated war requirements.

At the start of World War II in 1939, we produced 18,633 flasks of quicksilver from 107 producers. It took four years to work up to our maximum production from this start, and in 1943, 51,929 flasks were produced by 146 mines.

If our quicksilver need in a possible World War III is as much above that of World War II as this war's need was greater than that in World War I, then we would have quite a large requirement. This is possible, as new war uses for quicksilver were just coming into being when World War II ended.

Long Time Required

With a dead industry to revive, it would probably take longer than three or four years to work up to a sizeable production. If the stockpile should prove inadequate to cover the requirements of this period, the need could be acute. Under present conditions the industry is certainly dormant, if not dead. The last war just about cleaned up low-grade reserves, such as dumps, easily accessible outcrop ores, and old stope fills at the mines. A revival of production now would call for underground development and mining, which takes more time and money to bring results than does surface or dump mining. Practically no new quicksilver miners have been trained in the business for the past ten years. It takes about two years to train a good man for work in this industry.

Large sums of money spent in rehabilitating old mines for war production have been wasted by the shutdown of the industry. Many access tunnels and shafts have caved. A revival of the industry would necessitate reopening these workings again at greater cost. Much new financing must be undertaken. I venture to say that not a single reduction plant, where they are still at hand, could be started without major repair and replacement work. The mining equipment would also need extensive replacement and repair.

To do all these things under war conditions, with their attendant controls, draft, allocations, restrictions, rationing, sanctions, excess profits tax, renegotiations and other nightmares, would be almost impossible.

Industry Can Produce

Our domestic quicksilver industry has a good record. In both World Wars I and II it produced the full requirements of quicksilver needed and both times under severe handicaps and price restrictions. If it is thought that war threatens and that domestic quicksilver will be needed, I would suggest that an effort be made to keep the industry alive and bring it to a production level of some 15,000 to 20,000 flasks per year. An industry of this size would constitute a nucleus which could be quickly expanded to meet emergency demands.

The recent abrupt jump in the price of quicksilver to figures exceeding all previous levels should prove the fallacy in the thinking of those who were so sure that we could buy unlimited amounts of quicksilver at $60 per flask from foreign sources. We are likely to be able to buy "cheap" foreign quicksilver only when domestic production offers competition.

Consumers of quicksilver now have to pay high prices, and face the possibility of heavy inventory losses if the price should be cut as abruptly as it was raised. Both domestic consumers and producers would benefit from a stabilized market high enough to permit the operation of domestic mines.

The continuance of present high prices is so uncertain that few, if any, of the former large producers will care to undertake the cost of reopening their mines. There will be promotions of smaller mines by speculatively inclined persons with little experience in the business and hampered by greedy owners trying

to get their's while the excitement lasts. Usually such activity results in but little production and does the industry more harm than good.

All three of the past production peaks showed a rapid response to increased prices. Fortunately, the war needs for both World Wars I and II could be met by expanding the operations of a live industry that had a good backlog of operating mines, plants and trained crews.

The continuance of a metal mining industry depends on the development of new ore in operating mines, the development of new mines from prospects and, of course, initially on the finding of new prospects. These are fundamental operations that require the expenditure of risk money. They become active when the chance of suitable reward for such risk-taking exists. The greater the chance of profit, the more activity is engendered. Research and experimental work on new mining and metallurgical methods have greatly aided the business of quicksilver mining since 1910.

Five Year Floor

What is needed to revive production is a Government-guaranteed floor price of about $200 per flask. This would be roughly equivalent to the actual price that domestic producers received in the decade before World War II. An offer by Government to buy for the stockpile all domestic quicksilver offered to it at $200 per flask for 3 to 5 years would create the necessary assurances to warrant an orderly revival of our domestic quicksilver mining industry.

Up and Down History

From 1850 to 1913 United States production was in excess of domestic consumption. The excess production was sold in a fiercely competitive world market.

In the period shortly before World War I, competition of foreign quicksilver, i.e., imports, depressed the price from $47 to $40 per flask in 1913. In 1913 a 10% ad valorem tariff replaced a 7c. per pound rate and thus lowered tariff protection by $1.30 per flask. Labor legislation in California increased costs at the mines and the industry was in a depressed state. Had it not been for the discovery of a new orebody at one California mine, the decline in production would have been much more marked in the years just before World War I.

In the five pre-World War I years of 1909-1913 inclusive, the average annual imports of quicksilver were 1,565 flasks. In the five post-World War I years the imports averaged 14,079 flasks per year. This enormous increase in imports, then as now, was based on the European need for dollars, and their quicksilver was sold here regardless of price.

As the price dropped from 1918 to 1921, more and more mines closed down, tonnage treated declined, and the grade of the ore treated by those mines remaining in operation rose from 6 to 12½ lbs. per ton.

In anticipation of dumping by European producers, the domestic industry sought tariff protection as early as 1918. By 1921 only a few mines were still active and finally in September of 1922, a duty of 25c. lb. was placed on quicksilver imports. The price recovered gradually to 1926 and a modest increase in production followed, although still hampered by imports, which continued large and rose to 25,976 flasks in 1926.

In 1926 the European producers began to work under a series of agreements to control the production and price, and these agreements culminated in a virtual cartel some years later. They raised the price but they forgot to limit production.

Beginning in 1927 a severe overproduction ensued in the Spanish and Italian mines. High prices were maintained to 1930, but unsold stocks of metal piled up until the European surplus reached some 190,000 flasks in 1933. The Italian and Spanish mines virtually ceased operations for a time while this surplus metal was unloaded, mainly in the United States.

Ever since World War I, the domestic quicksilver industry, except during World War II, has suffered from its marginal world status, complicated by zigzagging prices and occasional dumping due to the actions of a foreign cartel whose policies have often seemed designed to wreck the domestic industry.

Where the Metal Came From

Throughout the history of the domestic industry, California has been the principal producing state.

Quicksilver ore was discovered in California in 1824, and in 1846 production began with crude retorts and furnaces. Up to 1889 California was the only quicksilver producing state, but in that year, Texas also became a producer from new discoveries of ore in the Big Bend region.

In World War I, California and Texas dominated production, while Oregon and Nevada contributed smaller additions. In the second or cartel peak, California and Texas production was not nearly so dominant, Oregon and Nevada appeared as important producers, and Washington and Arizona entered the list as producing states. In the depression period from 1933 to 1939, Nevada production declined and Arizona and Washington faded out. Oregon production continued strong and Arkansas and Idaho were added to the producing states. The World War II peak was a tremendous performance, in which all the aforementioned states contributed and Alaska was added to the list of producers. Texas production responded least to this demand.

The older mines responded in high-price periods. Some that made feeble response in 1917 were large producers in 1943. There were many of the older mines that could have added materially to the production of World War II had they been adequately financed and equipped. Some were just getting to the productive stage when the 1944 drop in price caused well-laid plans to come to naught.

Texas Shows Promise

Texas made a poor showing in World War II, but is potentially a very promising area for the finding of high-grade orebodies. The entire mining economy of the region was based on low-wage Mexican labor and hand methods. This economy was upset by the wage-hour law of 1938. As this remote and sparsely-settled region has no other labor available, its quicksilver mining industry languished and died in the World War II period of labor shortage.

In the cartel peak of production of 1929-1931, Texas production came from the Chisos, Big Bend, Oakes "39," and Rainbow mines, of which the last two were new producers. Nevada had new mines in this period, like the B & B, Red Rock, Castle Peak, Nevada, Pershing, as well as production from many small mines in the Pilot Mountains and elsewhere. Oregon had increased production from a new plant at Black Butte and from two new mines, the Opalite and Bretz properties. Washington entered the list of producing states with two new mines, the Barnum McDonnell and the Morton mine. Arizona had two new mines operated by Mercury Mines of America and the Arizona Quicksilver Cor-

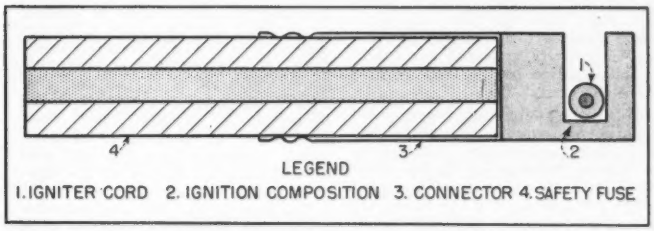
poration respectively.

This was a splendid recovery of an industry which had been laid low in the depression of the early twenties and proved that not only could new reserves be developed in old mines, but that new mines were still to be found, and not only in California and Texas.

The quicksilver industry came through the depression years of 1932-1939 in fair shape; in fact, it grew a little. In Oregon the Horse Heaven and Bonanza mines were added to the list of producers, a new quicksilver mining district was found in Arkansas, and the Idaho-Almaden mine in Idaho went on production. In California, the Mirabel, Great Western, Klau, and Red Rock were reopened and Mt. Diablo became a producer. As illustrated, the tonnage treated went up in these years and the "real" price was substantially higher than the dollar price, which of course favored the industry. Nobody was getting rich, but the industry was doing well enough with labor and supplies reasonably low in cost and a gradually rising price. Development was active, crews were being trained, and new plants were being built.

Thus in 1939, the industry was in good shape to respond to the increased demands of World War II. In Oregon and Nevada particularly, prospectors had become familiar with quicksilver ore and their diligent search had found between 300 and 400 quicksilver occurrences in these states alone.

In World War II California mines exceeded their World War I production, mostly from old mines but also from a fair sprinkling of mines that had not been notable producers before, such as the Mt. Diablo, Reed, Mahony, Red Rock, Falcon and Contact mines. In Oregon the Bonanza mine was added to the list of large producers. In Nevada many smaller mines contributed to the impressive total and Cordero emerged as a large producer. In Arkansas a notable production was achieved from a number of fair-sized mines, and in Alaska the Red Devil became the outstanding producer. In Idaho the Hermes mine production raised Idaho to 4th place among producing states in 1943.



END OF SAFETY FUSE with igniter cord connector crimped on one end. Note the slot for the cord.

Igniter Cord for Lighting Safety Fuse

TWO TYPES OF IGNITER CORD, a device for lighting safety fuse, are in use today in the mining industry in North America. The product used in the United States is made by Ensign-Bickford Co. and up to the present has been employed in a limited way. In Canada, the cord developed by Canadian Safety Fuse Co. is being promoted actively under the name of Thermalite.

Igniter cord is cord-like in appearance and, when lighted, burns progressively along its length with an external flame at the zone of burning. The flame is usually short and quite hot. Two varieties are available. Type A, greenish in color, has a burning rate of 8 to 10 sec. per ft. and is meant to be used at stope breasts where holes are collared 2 to 4 ft. apart. Type B, of a pinkish color, has a burning rate of 16 to 20 sec. per ft. and is meant to be used in development headings where holes are drilled relatively close together. Both types are marked at one-foot intervals.

When using igniter cord, the round must be so connected that the fuses of the last holes to be lighted will have burned to their collars before the first one fires. This is so that no unburned portion of fuse remains outside the collar where it could be severed by flying rock when the first hole detonates. Thus the number of holes that may be lighted in any one blast is governed by the "Limiting Cord Distance". For calculating this the rule is followed that Thermalite A burns four times and Thermalite B twice as fast as brands of safety fuse currently made by the Canadian manufacturer.

Two main advantages are claimed for igniter cord, according to T. J. Harkness, of the Production Engineering Department of Hollinger Consolidated Gold Mines, in Ontario, in discussing Hollinger's use of this blasting device. They are:

1. With this method of spitting fuses, the blaster need not remain at the face any longer than required for lighting a single fuse.

2. The intervals between the lighting of fuses in various holes can be increased enough to ensure firing in proper rotation. With igniter cord all fuses are cut the same length. Thus the delay interval between the holes is approximately equal to the time consumed by the burning of the igniter cord from one fuse connection to the next.

The only regular use made of igniter cord at the Hollinger mine is in blasting some raise rounds. All raise fuse is cut 8 ft. long. On one end of the fuse is an ordinary blasting cap, and on the other end an igniter-cord connector, shown in the sketch. This is of the same size and shape as a No. 6 blasting cap, but is copper-colored and has a composite bottom ignition charge consolidated under pressure. There is a slot near the closed end in which the cord can be placed and crimped by thumb pressure on the bottom of the connector to hold it securely in contact with the ignition charge.

In use the holes are loaded in the usual way. Then the igniter cord is strung through all the connectors in the proper order and with enough space between connectors to give proper firing rotation. After lighting the igniter cord in the proper place, the blaster leaves the face. The cord ignites the bottom of the connector which in turn ignites the safety fuse.

The aforesaid Canadian Safety Fuse Co. warns that inasmuch as igniter cord has been designed to burn vigorously with a hot external flame, it should be kept away from open lights, lighted cigarettes, etc.

WASHINGTON REFLECTIONS

Further Delays in Mineral Activity Result from Reduced Objectives and Public Apathy

The Department of Defense and the mobilization agencies under Charles Wilson are struggling to keep the mobilization program on schedule in the face of growing apathy on the part of politicians and the public. Relaxation is in the air, the inevitable impact of less excitement in the headline on a people who have been so played upon by events and journalistic needling that they no longer respond to ordinary stimuli.

The fundamental danger is as serious as ever, and the logic is incontestable of reaching the declared armament objectives as soon as possible. However, it seems almost impossible for the public to dedicate itself to sacrifice if the politicians lend themselves to relaxation—and the unwillingness of politicians to push unpleasant policies is notorious.

Moreover, the mobilization authorities have gradually been bringing their various policies in line with the limited objectives defined by top mobilizer Wilson. The public, and even the defense agencies themselves, have had difficulty adjusting themselves to the fact that this mobilization is different from all-out war. Inadvertently, people have drifted toward expecting the kind of impact on business and civilian life that we experienced in World War II.

But it hasn't worked that way. To understand what lies ahead, it's important to understand what the difference is.

First, we're not starting from scratch this time to build an army, a navy, an air force, and a merchant fleet. Therefore the relative need for steel won't be as heavy this time. Lead and zinc supplies haven't been hit as hard as some other materials. There's enough aluminum expansion in sight to satisfy the top mobilizers. Even copper was a surprise. We had a lot of munitions in storage when this mobilization started. We've learned how to make some sizes of shells out of steel and rockets are doing a bigger job. The result is a much lighter military requirement for copper than anyone would have guessed, based on World War II experience.

Another great difference is that this mobilization has a limited objective. It is not designed to build up an armament which could defeat Russia in a war, but aims at building up enough supplies for a year's fighting in case Russia starts a war, in the hope that such preparations would deter Russia from provoking war. Unlimited expansion along lines not needed to fulfill this limited objective would only interfere with getting the whole job done. For example, unlimited expansion of steel ingot capacity would tie up productive capacity needed to finish the mobilization job. That's why the top planners are going to call a halt to steel ingot expansion beyond the 120,000,000 tons per year now in view.

However, you'll not see them halting expansion elsewhere in the iron and steel industry for some time. Iron ore, for example, must catch up with steel ingot capacity now in sight. That's why you'll find 5 iron ore expansion projects approved for quick tax amortization on the last "certificate of necessity" list.

So, when mobilization bosses talk about having enough steel ingot capacity, they mean enough to complete the limited mobilization in the next two years. After that, there must be enough steel to satisfy the needs of the civilian economy, plus the much smaller armament load that we must expect to carry until the Communist menace abates.

Another difference with this mobilization is that, compared to World War II, there is much greater emphasis on electronics, jet engines, rockets, and guided missiles. This means that instead of the heaviest drain being on the basic metals, it's on the alloys. For example, tungsten represents one of the most serious metal shortages in the mobilization effort right now. Tungsten is needed now for the heat-resistant steels that go into jet motors, and for electronic devices. Other metals going into jets are chrome, cobalt, columbium, nickel and molybdenum, and these, also, are near the top of the shortage list.

In early April, DMA announced a 5-year floor price of $63 per unit domestic tungsten. This reflects the urgency of tungsten for defense and the testimony of operators that a period of price security is needed to get new production.

A fourth difference is that this mobilization includes raising the production of civilian goods. There has to be a short-run cut-back, of course which is what we experience in the flood of NPA rules and regulations. But the mobilizers consider an important part of their job to be the restoration of a 1950 civilian standard of living by 1953, along with a $50 billion output of munitions. So they aren't going to cut civilian products back any farther than necessary to fill the military orders. That's why steel use for civilian consumer durable goods like automobiles and refrigerators, has been cut back only 20% compared to the first part of 1950—scarcely a hardship economy so far as consumers are concerned.

Hesitation in Minerals

Because the mobilization effort, after the first helter-skelter jump at the problem, is being boiled down to needs in consonance with limited objectives, a new source of delay enters the picture. In the minerals field, projects and policies which have been approved by Defense Minerals Administration, are being given a careful screening by Defense Production Administration with a view to holding Government activity to the minimum necessary to meet the declared objectives. This, along with strongly rumored cutbacks in copper and zinc stock-piling rates, may result in the Government's backing away from stimulation of production of such metals as copper, lead, and zinc, and concentrating its efforts on the strategic metals in short supply.

The plan to put the Government's $10,000,000 mineral explorations plan into effect is being bounced back and forth between Defense Minerals Administration and the other agencies who must approve the details. A plan was drawn up by Defense Minerals shortly after expenditure of the money was approved. First, the Secretary of Interior returned it for minor changes, then the Bureau of the Budget, and now the National Production Authority is holding it up. There are no matters of basic policy under discussion, according to reports, mostly matters of i-dotting and t-crossing. However, in the atmosphere which has developed in Washington, it seems unlikely that the plan will be very effective in changing the pattern of domestic mineral exploration, an unlikely result, anyway, where the operator must furnish half the funds.

Several Mining Projects Obtain Quick Amortization

Bethlehem Steel Co. topped mining projects approved for fast tax amortization on the list approved by the Defense Production Administration from Jan. 25 through March 7. The company received certification for $34,343,000 for its Grace mine at Morgantown, Pa., covering concentration facilities and mine development. It received one certificate for $4,037,000 and one for $77,000 in separate projects for increasing mining facilities at its Cornwall operation in Chester County, Pa.

Armco Steel Corporation got certifi-

cation for $1,500,000 to expand mining in its brown ore iron deposits in east Texas.

W. S. Moore Co. get certification for $175,000 for a heavy density unit for the Prindle mine, Virginia, Minn.

The percentage of tax write-off per year is determined individually in each case, Defense Production Administration announced in making the list public. Mining projects averaged about 85%. Altogether, 231 companies on the list got certificates of necessity for 313 projects. The approved projects totaled $1,183,424,159.

The new list, plus earlier approvals, puts the grand total of certified projects at about $3 billion. By far the biggest portion has gone to iron and steel projects — $1.9 billion worth, nearly two-thirds of the total.

A few days before the new list was released, DPA administrator Harrison issued his first general policy statement, firmly establishing the granting of acceleration amortization on a basis related to the urgency of the project. Percentages range from 50 to 100, depending on the project's importance to the mobilization effort, Harrison said. Only a dozen or so companies have gotten amortization on 100% of the cost of facilities. These included some petroleum, chemical, and machine tool projects, but no mining programs. Mining projects on the list averaged about 85%, one DPA official indicated.

Special Treatment Seen for Mining Requirements

An order which would grant makers of mining machinery the power to get necessary supplies with DO rated orders has been cleared by Defense Minerals Administration and is in the office of NPA Administrator Manly Fleischmann for signature. Authority to use the DO symbol has been granted to makers of electric power equipment, makers of oil well supplies, builders of railroad cars and other defense-supporting industries. Defense Minerals hopes the higher-ups will get around to mining fairly soon.

When NPA issued its order allowing every business in the country to write its own DO orders for maintenance, repair and operating supplies, it admitted that the general program wouldn't work for mining. A special order for mining was prepared weeks ago by Defense Minerals Administration, and is also in the NPA Administrator's office for signature. Chief complaint of the industry is the ruling that MRO orders can be given DO ratings only up to the dollar volume of such orders in 1950. This quota isn't sufficient for an expanding industry, mining spokesmen have pointed out. Chances are that the special mining program for MRO, when it is finally signed, will keep the 1950 base period, but allow mining something more than 100% of the base period.

LABOR THIS MONTH

Joseph M. Gambatese, McGraw-Hill Washington News Bureau

MANPOWER: This is the month when finding (and keeping) miners begins to get tougher. Reports coming to Washington show that, up to now, recruiting metal miners has been comparatively easy. But manpower stringencies are expected to begin in April. That's when construction and lumbering picks up, and more aircraft plants and shipyards open.

SPECIAL REPORT: U. S. Department of Labor's survey of lead and zinc mines shows this situation in January:

Weekly wages rose to $74.56 level from a two-year low of $59.87 in August, 1949.

Hourly earnings reached $1.74.

Wage increases were granted by three-fourths of the mines. Usually 10 to 15 cents an hour. Some tied bonus or wage boost to prices. Three low-wage mines raised hiring rates almost 50 cents an hour. Most entry wages were between $11 and and $12 a day.

Longer hours are being worked. Since Korea, workweek is up three hours to 43-hour average. Only 14% of mines scheduled less than 48 hours.

Employment, at 20,600, is 20% above October, 1949, but still below the 23,600 of two years ago. Increase of 5% is expected between April and July. Out-of-state recruiting through public employment officers is being resorted to by some Northwest mines.

Labor turnover is still high. Almost 4.5% left the mines, most of them quitting. The rate will rise with good weather. Yet more than 5% were added to payrolls, making a slight net gain.

CRITICAL JOBS: The list of "critical jobs" used by the Defense Department as a guide in delaying the call of reservists and members of the National Guard has been sent to local draft boards as "information" in considering draft deferments. Defense Minerals Administration is getting some complaints from mine operators about the draft.

HELP ON RESERVISTS: DMA can help you get an indefinite deferment for an irreplaceable key man in the reserves or National Guard. It can't guarantee, but has gotten a few of them. Send pertinent information to DMA—before the call comes. DMA will take it up with Defense Department.

TRAINING: Labor Department's apprenticeship bureau has started its first mining training program in an Idaho mine. It's an experiment. If it can be "sold" to other companies, more training units will be set up.

COMMUNIST LINE: Mine-Mill's executive board still twists with the Communist Party line. You can see it in resolutions from the first meeting in Denver:

"Pull out of Korea."
"No troops to Europe."
"Against defense mobilization."
"Against copper stockpiling."

IN THE MIDDLE: You still must bargain with a Communist-dominated union as long as valid non-Communist affidavits of leaders are on file. Department of Justice is moving slowly on perjury charges. But FBI is keeping close tab on commies in defense activities. And the CIO is bringing pressure on the Defense Department to step in. This would help CIO's drive on the expelled left-wing.

AN OUT: Dealing with Communists within the labor law is touchy. An Illinois manufacturer did this: He suspended two union officials (who signed non-Communist affidavits) after they were branded as Communists in a libel suit.

He told them (1) if charges were true, suspensions were justified; (2) if they were proved false, to company's satisfaction they would be reinstated. NLRB's general counsel backed up the company by refusing to issue unfair labor practice complaint.

FAMILY BUDGET: BLS has issued revised city worker's family budget — providing "modest, but adequate" level of living—for family of four (one working). It is for October, 1950, and covers 34 cities. Unions will use it for wage bargaining. Denver ranks 16th from the top, with annual family budget of $3,739. Cities with higher budgets in order of rank: Milwaukee, $3,933; Washington, D. C.; Richmond, Va.; Houston, Atlanta, San Francisco, Seattle, Boston, Los Angeles, Memphis, Pittsburgh, Jacksonville, Baltimore, Detroit, and Chicago ($3,745).

WAGE CONTROLS: Feeling is growing that nobody in Washington really wants wage controls. They will continue lax until Defense Production Act is amended in June. Truman wants stiffening. Actually, Congress may react the other way: ease controls.

THE FORMULAS: Wage rises caused by escalator clauses in old contracts won't be stopped for the time being. The 10% cost-of-living catchup may be pushed higher by June.

MARKETS—Trends and Prices (*Continued from page 69*)

Manganese Ore in 1950

Shipments from domestic mines of manganese ore (natural) averaging 35% or more Mn increased 10% during 1950 to 139,000 short tons, which was greater than any year since 1946. Imports of manganese ore established a new all-time high of 1,837,950 tons. India supplied 34% of the total, the Union of South Africa 26% and the Gold Coast 18%. General imports in 1950, by countries, in short tons:

Source:	Battery Grade Gross Weight	Battery Grade Mn Content	Other Gross Weight	Other Mn Content	Total Gross Weight	Total Mn Content
Angola	.....	.....	13,124	6,813	13,124	6,813
Belgian Congo	.....	.....	5,942	2,885	5,942	2,885
Brazil	.....	.....	129,721	58,652	129,721	58,652
Canada	.....	.....	57	31	57	31
Chile	554	255	8,248	3,892	8,802	4,147
Cuba	8,704	4,067	88,212	40,046	96,916	44,113
French Morocco	6,535	3,600	21,301	11,096	27,836	14,696
Gold Coast	68,835	38,258	259,264	124,947	328,099	163,205
Greece	.....	.....	440	178	440	178
India	10,948	5,042	622,222	295,954	633,170	300,996
Iran	.....	.....	1	(a)	1	(a)
Mexico	126	55	38,720	17,279	38,846	17,334
Peru	.....	.....	823	485	823	485
Philippines	.....	.....	6,074	2,663	6,074	2,663
Portugal	.....	.....	447	188	447	188
West Portuguese Africa	.....	.....	1,098	593	1,098	593
Turkey	.....	.....	5,675	3,121	5,675	3,121
Union of South Africa	5,928	2,668	469,388	201,931	475,316	204,599
U. S. S. R.	.....	.....	65,563	31,632	65,563	31,632
Total	101,630	53,945	1,736,320	802,386	1,837,950	856,331

(a) Less than one ton.

Official London Prices

The British Ministry of Supply revised its delivered prices of copper, lead and zinc for the United Kingdom. Quotations in effect beginning April 2 follow:

	Per Long Ton £	s.	d.
COPPER:			
Electrolytic, high conductivity	210	0	0
Fire refined, high conductivity	210	0	0
Fire refined, high grade	209	10	0
Fire refined, min. 99.7 percent	209	0	0
Fire refined, min. 99.2 percent	208	10	0
LEAD:			
Soft, foreign duty paid	160	0	0
Soft, Empire	160	0	0
English, refined	161	10	0
ZINC:			
Foreign (G.o.b.) duty paid	160	0	0
Domestic (G.o.b.) duty paid	160	0	0
Prime Western and debased	160	0	0
Refined and electrolytic	164	0	0
Minimum 99.99 percent	166	0	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

March 31, 1951

Aluminum, ingot, 99 plus percent, lb. (base price)	19c.
Antimony, spot, lb., 5 tons and up but less than carload in cases	45.280
Bismuth, ton lots, lb.	$2.25
Cadmium, commercial sticks, delivered, lb.	$2.55
Calcium, lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.07
Cobalt, 97 to 99 percent, per lb.	$2.10
Indium, troy oz.	$2.25
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	50½c.
Magnesium, 99.8 percent, carloads, lb., producer's plant, Freeport, Texas	24½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$90.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$218 @ $221
Selenium, 99.5 percent, lb.	$3.00
Silicon, minimum 97 percent, spot, carloads, lb.	16.50c.
Tellurium, lb.	$1.75
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 96 to 98 percent, lb.	$5.00

(a) Includes U. S. duty.

METALLIC ORES

Beryllium Ore, imported, 10 to 12% BeO, per unit	$28.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 44% Cr_2O_3, no ratio	$24.00 @ $25.00
48% Cr_2O_3, 3 to 1 ratio	$38.00 @ $48.00
Iron Ore, Lake Superior, Lower Lake ports, long ton: Old Range bessemer	$8.70
Mesabi bessemer	$8.45
Mesabi, non-bessemer	$8.30
Lead (Galena), 80 percent, Joplin, Mo., ton	$218.42
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, $1.05 @ $1.10., c.i.f. U. S. ports, duty extra. Long-term contract quotations wholly nominal and matter for negotiation.	
Molybdenum Ores, 90%, per lb. of MoS_2 f.o.b. mines	60c.
Tantalite, 60% concentrate, per lb.	$2.00 @ $2.50
Tungsten Ore, per unit of WO_3 Foreign, 60 percent, U.S. equivalent, duty paid	(a) $76.50
Domestic, scheelite, 60 percent f.o.b. mine	nominal
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	31c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$115.00

(a) Nominal.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	6½c.
Cobalt Oxide, 72%, metallurgical grade, per lb. of Co	$2.25
Copper Sulphate, 100 lb.	$8.95

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of alloy, 5 lb. ingot	$1.56
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	21¼c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$185.00
Ferromolybdenum, 55 to 65 percent Mo. lb. of Mo. contained	$1.32
Ferrosilicon, 50 percent, per lb. of contained Si	12.4c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	(a) $3.25
Ferrovanadium, per lb. of V delivered	$3.00 @ $3.25
Silicomanganese, max. 1½ percent carbon, per lb. contracts	9.9c.
Spiegeleisen, per long ton, 19 @ 21 percent grade	$75.00

(a) Nominal.

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds), ton: Crude No. 1	$960 @ $1,500
Crude No. 2	$595 @ $900
Spinning fibers	$275 @ $475
Shingle fibers	$123 @ $170
Paper stock	$85 @ $119
Waste	$63 @ $70
Shorts	$30 @ $63
Asbestos, Vermont, f.o.b. Hyde Park: Shingle stock	$97.00 @ $107.00
Paper stock	$68.50 @ $85.00
Waste	$51.00
Refuse or shorts	$25.50 @ $46.50
Barytes, f.o.b. mines: Georgia, crude, per long ton	$13.00 @ $13.50
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$9.25 @ $9.50
Bauxite, long ton, f.o.b. point of shipment: Domestic, crude, 50 to 52 percent (not dried)	(a) $4.50 @ $5.50
Domestic, chemical, 55 to 58 percent	(a) $8.50 @ $9.50
Domestic, abrasive, 80 to 84 percent	$18.00 @ $18.50
China Clay, f.o.b. mines, ton: Georgia, filler and ceramic grades	$8.50 @ $9.50
North Carolina ceramic grade	$20.25 @ $22.25
Feldspar, bulk ton: Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @ $22.25
Glass feldspar, white, 20 mesh	$11.75 @ $12.50
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois, 70% effective, CaF_2, ton	$43.00
Acid 97% concentrate, bulk, ton	$50.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @ $14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$36.30
Mica—Domestic, f.o.b. mines. Punch 12 to 22c. per lb. according to size and quality. Sheet, clear, 1½ x 2 inch, 80 to 85c.; 2 x 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch, $1.80 @ $1.90; 3 x 4 inch, $2.10; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $120 @ $130 per ton. Bulk sales, dry ground, $32.50 @ $60.00 per ton. Scrap, $32 and up.	
Ocher, Georgia, ton, in sacks	$24.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a) 12 @ 14c.
Sulphur, Texas, mines, long ton	$22.00
Talc, f.o.b. works, ton: New York, purified	$18.50 @ $20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton: 40 mesh, cream colored	$30.00

(a) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces	$52.00
Steel, f.o.b., Pittsburgh billets, net ton	$56.00
Structual shapes, 100 lb.	$3.65

KEEPING TAB ON PRACTICE

Tungsten Carbide From Scrap. The Titania Co., at Hauge i Dalane, Norway, makes new bits out of its carbide scrap. They have been using Coromant carbide-tipped steel with chisel bits for five years. Having accumulated a heap of scrap carbide by the end of the second year, according to R. M. Brun, assistant manager, they sought to salvage the carbide and, after experiments, succeeded in making new bits from it as follows:

After separating the inserts from the steel by heating, they cut and ground the carbide pieces to suitable dimensions. Two to three pieces were enough to make a new bit. Equipment for doing this retipping was made in the company's repair shop at $400 cost. It consists of a small machine for combined hot and cold milling. The front of the steel is reforged, the slot for the inserts is hot-milled in one cut and cleared to the exact dimensions by cold milling. Soldering is done in an ordinary oil furnace and the bit is cooled for 8 hours in lime.

Mr. Brun puts the cost of making a new bit out of several broken ones at less than 50c. He states that this procedure will give 15 to 50% greater footage out of the carbide, and the drill steel can be reused.

Carbide drilling, when started by Titania in 1946, gave 425 ft. per bit. This footage was increased to 700, as an average for all bits, in 1950.

In comparison, an ordinary carbon-steel bit will drill 2 ft. 8 in. between resharpenings, Mr. Brun states.

Some of the scrap carbide at Titania has also been used successfully in the workshop for lathe work.

That Front-Dump Skip. Claim is made for the front-dump skip devised for vertical shafts by A. W. Parkkonen, Negaunee, Mich. (*E&MJ*, March, 1951, p. 81) that it takes relatively little shaft space, loads rapidly by utilizing the contents weight to open the door, requires a lower headframe than presently needed, and stays within the headframe while unloading. A bulky door mechanism is not required. The door is held closed by a locking mechanism until it is desired to unload, at which time the mechanism is released and the doors swing upwardly and outwardly. Opening of the door under pressure, it is claimed, insures complete evacuation of heavy, tacky materials, and keeps mud or other material from escaping into the shaft or hanging up in the skip. Cleaner operation is said to result. The skip, it is also claimed, provides a larger, easier exit for the ore, without using additional space. The entire skip can be electrically welded, or rivetted.

Two-Wire Trolley System. Park-Utah Consolidated, Park City, Utah, employs trolley locomotives for main-level haulage, one unit using a two-wire trolley system, with the two wires about 5 in. apart c. to c. The other unit has the usual single trolley wire and bonded rails.

The two-wire system was installed chiefly because the back of the tunnel was low in places and the company wished to make it as safe as possible for men working and traveling through this main haulageway, according to Paul H. Hunt, vice president and general manager. No one has ever gotten a shock from it because of the short spacing between the wires. There is no connection between the ground and either wire. On the other hand, where the single-wire system is used, a man has often been knocked down by touching the wire with tools he is carrying. The system doubles the amount of copper and the number of wire suspensions but this is offset somewhat by not bonding the rail joints.

The two-wire system, it is thought, has no electrical advantages over the single-wire system where the rail bonding for the latter is good. The swivel trolley pole and swiveled harp for the two trolley wheels bearing on the two wires are as easily swung around and adjusted to the two wires as the single trolley wheel. They also ride the wires with as good a bearing contact, even at high speeds, as do the single wheels.

Keep the Safety Goggles Clean. Use of silicone-treated paper tissues for cleaning safety goggles, face shields, and windshields, and keeping them free from fog, is reported by several large mining companies. Containers for dispensing them are kept in some convenient place, such as the mine change house, near the point for changing cap lamps, the shop (or wherever emery or other grinding wheels or welding equipment are used), in short in or near the various areas where goggles are required to be worn.

Provision of these silicone tissues, it is held, will reduce the accident hazard of dirty goggles, also the possibility of eye strain, and in general make workers more safety conscious. Many companies are enthusiastic about the use of goggles and are ready to do almost anything to make them more acceptable. Workmen, prior to having these tissues made available, have been using toilet paper, handkerchiefs, flannelette gauze, and wiping rags.

A Battery-Trolley Difficulty. Fragile controls on its new combination battery-trolley locomotives gave a Michigan iron-ore operator trouble by continually arcking through, causing malfunctioning. This has been remedied by use of much lower voltages, obtained by tapping a few cells instead of the full 150 volts. The machines are of 6 tons nominal weight, and are built to carry about 2 tons of battery additional.

Faster Communication Underground. Greater mechanization underground is being accompanied by improvement in communications. Installation last November of a Trolleyphone system in an ore mine of a Southern operator was mentioned in our annual Survey in the February issue (p. 80). Installations were also made in the mines of another Southern operator late in January. In this system of communication, the voice is transmitted by a frequency-modulated carrier-current traveling over the d.c. trolley and feeder wire.

The first installation comprised eleven units, distributed as follows: Dispatcher's office, 1; shop, 1; large main-line trolley locomotives, 4; secondary haulage motors (except for spare equipment), the rest. This installation also serves for expediting repairs and delivery of parts from shop to working sections.

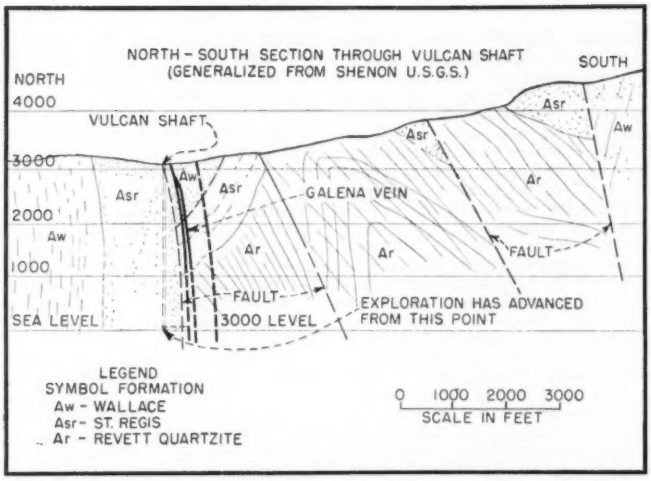
Nine Trolleyphones are comprised in the second operator's installations, six in one mine and three in the other. The installation at the former mine was made approximately Jan. 25, 1951, and so far is entirely satisfactory. Four units are located on main line locomotives, one on the electrical repairman's locomotive, and one in the dispatcher's office. The total distance to communicate from dispatcher to motorman is 1½ miles. This system of communication has brought about some increase in tonnage for the company and is felt to have introduced a system that makes for safer operation. One unit is on hand to serve as a spare, but to date no mechanical difficulties have been experienced in the operation of the phones. The men are enthusiastic about them, and, even though they operated many years without them in the past, it appears now that it would be difficult for them to dispatch and receive orders if they reverted back to the old method.

Vulcan Exploration Project Encounters Favorable Ore

PRELIMINARY LATERAL EXPLORATION work on the 2,930-ft. level of the Vulcan Silver-Lead property in Lake Gulch in the Coeur d'Alene district of Idaho has disclosed ore at this horizon. Great interest has been centered in this project because it represents the first deep-exploration attempt in the eastern portion of the well-known and highly productive Silver Belt of the Coeur d'Alene district which lies south of the Osburn fault and extends about 7½ miles eastward from Big Creek to Wallace, Idaho. Deepening of the Vulcan shaft (formerly referred to as the Galena shaft) and lateral exploration at depth were undertaken with the expectation that the Vulcan vein which produced ore in upper horizons in the 'Twenties would continue downward, and that new mineral zones might be encountered in crosscutting at depth. Both of these expectations have in part been realized.

The Vulcan property is being explored and developed by the American Smelting and Refining Co. under a 60-year lease and profit-sharing agreement with Vulcan Silver-Lead Corp., a subsidiary of Callahan Zinc-Lead Co. Day Mines, Inc. has a 25% interest in AS&R's lease agreement.

Enlargement and deepening of the Vulcan shaft from the 800-ft. level was started in 1947. The 2,930-ft. point was reached in 1950, after which lateral crosscutting and drifting were undertaken. Expenditures involved in this initial work totaled about $1,000,000. Results of the exploration project thus far are summarized as follows:



FAVORABLE ORE ZONES on the 2,930-ft. level of the Vulcan shaft were encountered by AS&R and Day Mines, Inc. in deep-level exploration of the Vulcan Silver-Lead Corp. property in the eastern section of the "Silver Belt" in the Coeur d'Alene district of northern Idaho.

Exploration Results

Exploratory work during the last quarter of 1950 encountered a mineralized zone adjacent to the shaft which has been termed the Vulcan vein. Development work on this vein through January, 1951, disclosed a length of 130 ft. of ore averaging 6.2 ft. in width, with average assay of 3.2 oz. silver per ton, 6.9% lead, and 1.6% zinc.

About 210 ft. south of the shaft a mineralized zone was encountered in the crosscut which extended for 320 ft. containing several narrow veins of relatively high-grade silver-lead ore. Drifting on one of these through January, 1951, disclosed 190 ft. of ore averaging 7.1 ft. in width with assays averaging 7.4 oz. silver per ton, 7.7% lead, and 0.4% zinc. This zone has been intersected by four diamond-drill holes in addition to the crosscut over a strike length of 600 ft. The drill holes disclosed mineralization similar in character to that encountered in the crosscut.

From exploratory work in 1950, 2,466 dry tons of ore from development were milled with an average assay of 2.69 oz. silver per ton, 4.0% lead, and 0.62% zinc. Royalties earned on this ore totaled $2,640. Although exploration results to date do not yet warrant estimates of the size or grade of orebodies, the status of the project is regarded as being highly encouraging.

Ore from the property is being concentrated by Zanetti Brothers who in the 'Thirties purchased the old Galena mill on the property and renovated it to treat tailings and custom ore.

Vulcan Silver-Lead Corp. was incorporated as a subsidiary of Callahan Zinc-Lead Co. in 1946 and acquired its present holding of 32 patented claims and 34 unpatented claims from the parent company. Vulcan Extension, Inc., another subsidiary, was incorporated in 1948 and later acquired the balance of Callahan Zinc-Lead's properties consisting of 2 patented and 32 unpatented claims east of the Lake Gulch area.

Joseph T. Hall, president of Callahan Zinc-Lead Co., is president of both Vulcan companies. R. F. Mahoney, formerly superintendent of the Sunshine Mining Co., is vice president and manager. H. J. Hull, Wallace attorney, is also a vice president of the company.

Silver Buckle Option

AS&R has also taken an option on 67% of Silver Buckle Mining Co. stock for a consideration of $1,392,000. The option runs for a period of six years and requires AS&R to spend $160,000 in development work, after which AS&R may surrender the option if desirable. Day Mines, Inc. will, presumably, have a 25% interest in the deal, since that company has a similar interest in the AS&R's 3,000-ft. Vulcan shaft development. The deal involves 6,700,000 shares of Silver Buckle stock. Part of the Silver Buckle ground is within 800 ft. of the deep shaft collar and is known as the Brass Ranch, and the ground easterly parallels the Vulcan holdings on the north side lines.

IN MINING

IN THE UNITED STATES

What Major Mining Companies Are Reporting:

- Homestake Acquires Interests in the San Juans.
- Inco Will Have World's Largest Underground Mine.
- St. Joe Develops New 9,000-Acre Property.
- Exploration Reveals More Good Ore in Magma's New East Orebody.
- Aguilar Ships Zinc Concentrates to Josephtown.
- AS&R Increases Sulphuric Acid Plant Capacity.

HOMESTAKE MINING CO. Ore mined in 1950 was 1,265,118 tons. Average value per ton realized was $15.23. Metallurgical recovery was 97.03%. By August, 1950, ore production was increased to 3,600 tons per day. Reserves of broken ore on Dec. 31, 1950, totaled 20,804,000 tons including 430,000 tons of broken ore. Construction work has been begun on the Yates crusher plant to add third-stage crushing. Similar remodeling will be done at the Ross crusher plant. When completed, stamps will be eliminated in the South mill.

During 1950, Homestake acquired a 10% interest in the **Idarado Mining Co.**, and a 20% interest in the **Atlas Mining Co.**, both controlled by the **Newmont Mining Corp.** Homestake received its first dividend of $80,000 from Idarado in Dec., 1950. The Atlas Mining Co. property is also in the San Juan area of Colorado. It contains some known ore, but its chief value is based on prospects for encountering new ore through deep exploration now in progress. In this respect Homestake regards it "as a good mining risk."

INTERNATIONAL NICKEL CO. OF CANADA, LTD. Deliveries of nickel in all forms in 1950 were 256,000,000 lb., constituting a record for any peacetime year, Dr. J. F. Thompson, president, disclosed recently. Deliveries in 1949 were 209,292,257 lb.

Receipts from sales of nickel, copper, platinum and other products for 1950 amounted to $228,000,000 (in terms of U. S. currency) which compared with $182,806,452 for 1949.

The company's current nickel production is at maximum capacity and is expected to be larger in 1951 than any peacetime year in its history. Barring unforeseen interruptions, the company will complete in 1953 its program of full conversion from surface to underground mining which has absorbed the major portion of its $100 million in capital expenditures over the past ten years. When this undertaking is completed, the company's underground mining operation will be larger than any non-ferrous base metal mining operation in the world — 13 million tons hoisted annually by 1953.

The volume of nickel deliveries in 1950 was made possible by increasing production with maximum speed and drawing on the reserve stocks of nickel. Military requirements of Canada, the United States and the United Kingdom are being met and deliveries are being made to government stockpiles. The balance of the supply is being rationed among civilian consumers in all markets throughout the free world.

The Frood-Stobie open-pit ores, which enabled the company to achieve its high output during the war and postwar years, will soon be mined out. It was in anticipation of this fundamental change affecting the company's production that the company embarked more than ten years ago on an extended program to replace open-pit capacity with further underground capacity. The problem was to obtain and treat more than twice as much ore per year from underground as ever before. The accomplishment of the program required extensive enlargement of underground plants and the revamping of metallurgical processes. Entirely new methods of mining not previously undertaken had to be developed to make possible utilization of the lower grade ores.

KENNECOTT COPPER CORP. Total production of the five operating properties of Kennecott for 1949 and 1950:

	1949	1950
Ore mined and milled, tons	39,815,862	55,017,828
Copper, lb.	872,482,498	1,152,065,960
Molybdenite, lb.	19,894,835	29,407,143
Zinc, lb.	5,583,250	5,413,875
Gold, oz.	296,818	450,174
Silver, oz.	2,384,043	3,586,763

Progress was made during 1950 in developing the affairs of **Quebec Iron and Titanium Corp.**, in which Kennecott owns a two-thirds interest. At Allard Lake, 100,000 tons of ore was

(Continued on page 144)

Bethlehem's New Iron Orebody in Pa. Is a "Geophysical Find"

DETAILS ON THE DISCOVERY of a substantial iron orebody by airborne magnetic methods near Morgantown, Pa., was recently revealed by A. B. Homer, president of Bethlehem Steel Co. News of the discovery was briefly reported a year ago. Mr. Homer elaborated as follows:

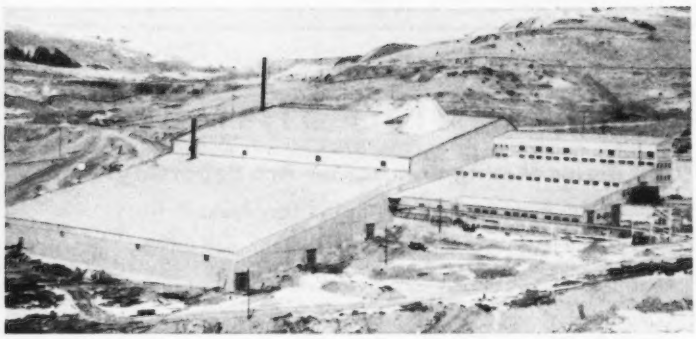
"The deposit is in the vicinity of Morgantown, a few miles from Reading . . . where it was generally thought that iron ore deposits had long since been worked out. However the newly found deposit is less than 30 miles from Bethlehem's Cornwall mines, and we have always believed there must be additional ore in this territory, and we have been prospecting continually."

"The deposit lies at a depth of 1,500 to 3,000 ft. below the surface. The ore is of the magnetic type, and can be concentrated into a product with an iron content of 60 to 70%."

Other details revealed by Mr. Homer were as follows: Discovery of the orebody was made with the aid of the airborne magnetometer. Sinking of two shafts will be started soon. It is expected that the shafts and the beneficiation plant for concentrating and pelletizing the ore will be completed in about two to three years. The pyrite in the ore will be shipped to Bethlehem's Sparrow Point plant where it will be converted into sulphuric acid in a new plant to be built for that purpose. When the new mine attains full production a force of 1,250 employees will be needed.

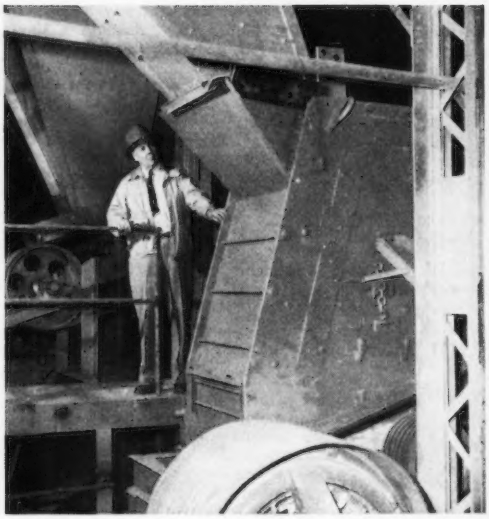
Size of the project is indicated by a Government report to the effect that Defense Minerals Administration had issued a certificate of necessity to Bethlehem Cub Iron Mines of Morgantown, Pa., for $34 million. Part of the cost of the project will be subject to accelerated depreciation.

LOWELL THOMAS, Victor's favorite son, touches off Golden Cycle's Cripple Creek, Colo., mill.

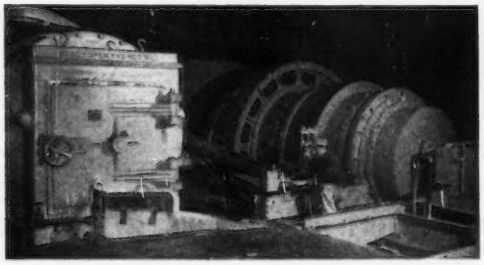


DEDICATION CEREMONIES, led by Thomas (left) on March 12, launched latest venture in district's 60 lively years. Golden Cycle moved milling center here from Colorado Springs; the new plant will use flotation, roasting, carbon cyanidation.

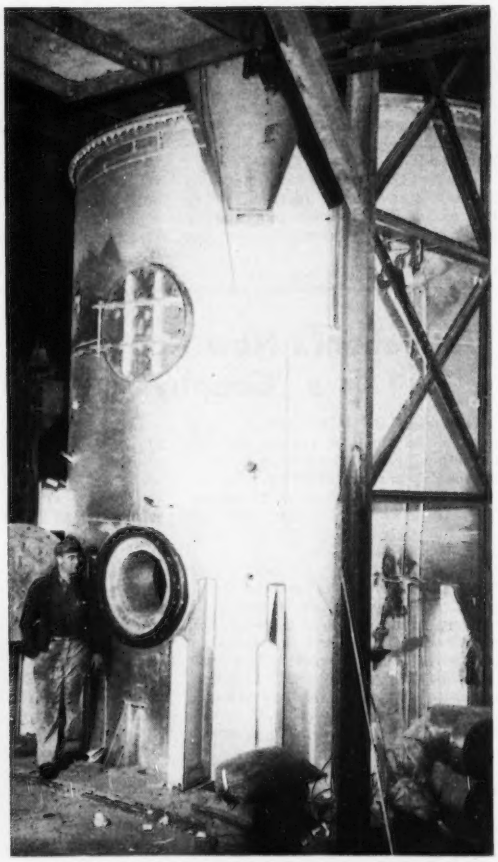
Gold Men Greet New Carlton Mill



MILL CAPACITY is 1,000 tons daily. Harold Worcester, assistant manager, points out Cedarapids primary crusher.



CLEAN DESIGN features Marcy and Dorr grinding circuit. Howard Keil, mill superintendent, adjusts classifier.



FLUO-SOLIDS ROASTER, examined by Robert Welsh, construction supt., is latest design, and is first in the west.

HAULAGE KEEPS PACE WITH PRODUCTION ON

Exide-Ironclad BATTERY POWER

Keep your mine haulage equipment moving at top speed, all day long, with Exide-Ironclad Batteries. They respond instantly and fully to all power demands—continuous or intermittent. And their large reserve power is ample for emergency needs. Exide-Ironclad Batteries also assure you:

ROUND-THE-CLOCK-PERFORMANCE—no unscheduled down time, no mechanical trouble, no slow-downs toward end of shift.

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EASY MAINTENANCE—rugged construction assures trouble-free operation, low maintenance and repair costs.

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WIDE RANGE OF EXIDE-IRONCLAD SIZES for all makes of battery-powered locomotives, trammers and shuttle cars.

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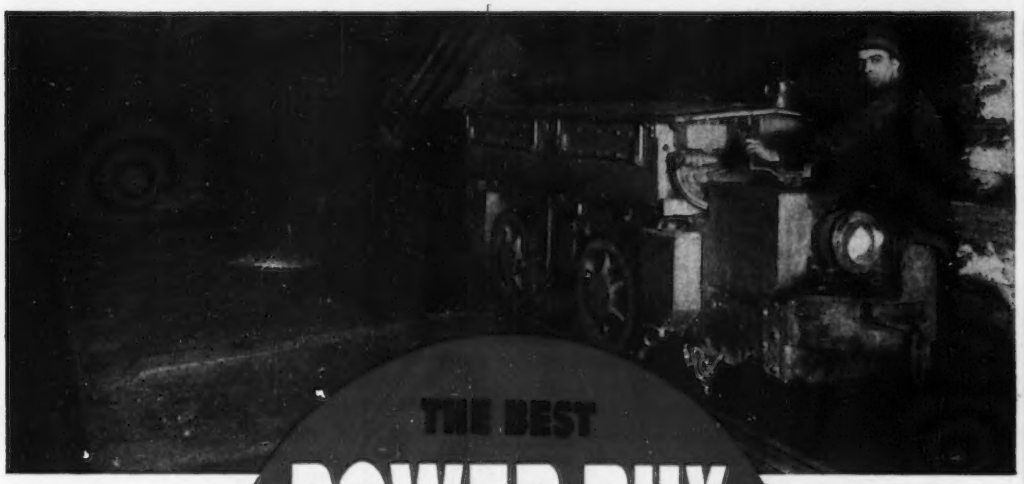
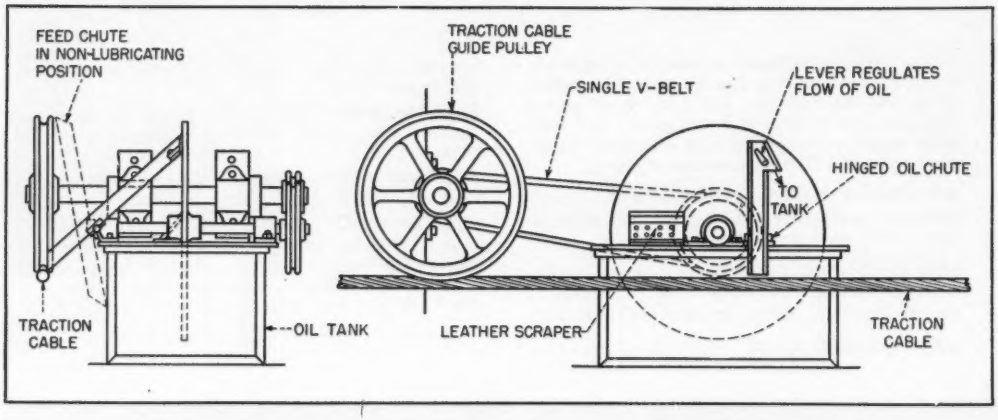


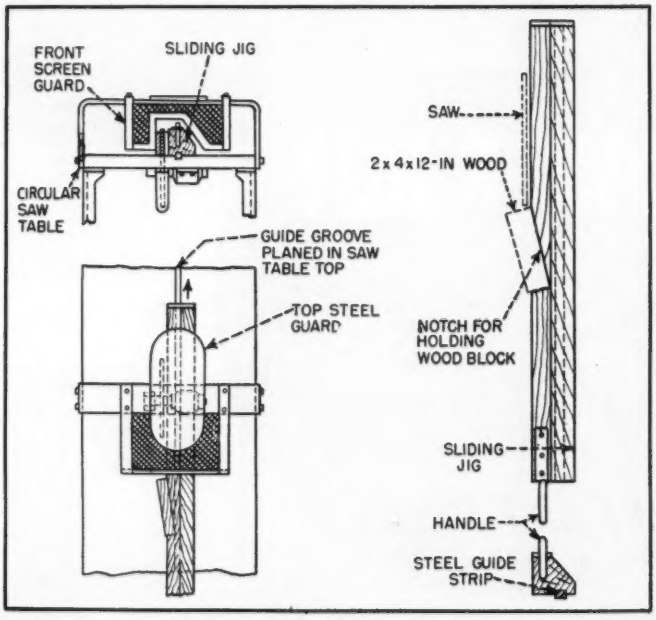
1888...DEPENDABLE BATTERIES FOR 63 YEARS...1951

OPERATING IDEAS



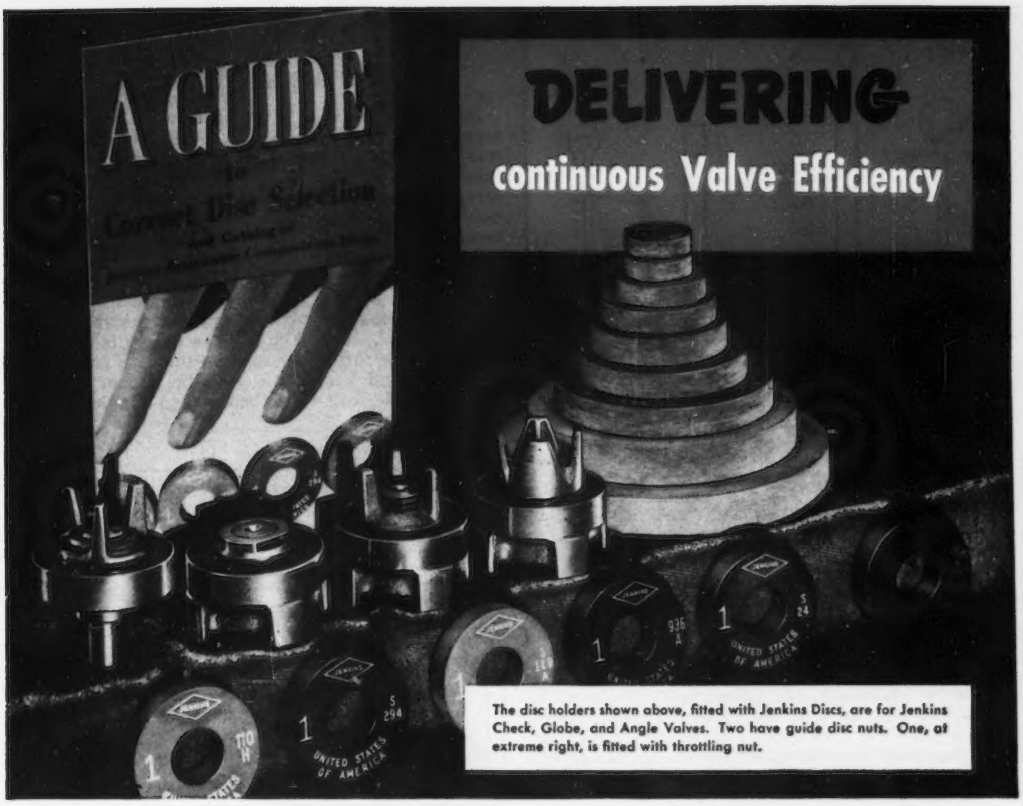
Automatic Lubricator for Aerial Tram Cable

The traction cable of an aerial tram operating at the Hornet mine of the Mountain Copper Co., Ltd., Matheson, Calif., is lubricated with this automatic device submitted by Victor Dahlgren, foreman in charge of the aerial tram. The unit resembles a reagent feeder used in flotation plants. It consists of an oil storage tank, revolving circular steel disk, hinged oil-feed chute or flume, and a leather scraper to remove oil from the section of the disk not in contact with the tip of the feed chute. The disk is driven by the traction cable guide pulley through a single V-belt. The quantity of oil which flows to the cable is regulated by adjusting the small lever or finger at the intake end of the feed chute. Surplus oil returns to the tank through an auxiliary channel. Flow of oil to the cable is stopped by tipping the feed chute to the non-lubricating position.



Simple Jig Speeds Wedge Cutting

Floyd Serpa, surface foreman at the Hornet mine of Mountain Copper Co., Ltd., Matheson, Calif., has speeded up the cutting of wooden wedges by using this simple jig. It operates on a conventional saw table available in most timber framing shops. A small groove is planed in the saw-table to serve as a guide for the sliding jig. The entire unit is well protected with top and front screen guards. The wooden sliding jig which is operated with a steel handle, contains a notch near the center to hold a 2x4x12-in. piece of wood which is sawed in two diagonally to produce two wedges. A steel strip is bolted to the bottom of the jig. This fits in the guide groove in the table top. To make two wedges, the operator merely places a 2x4x12-in. block in the notch of the jig, and then advances the block into the revolving saw.



The disc holders shown above, fitted with Jenkins Discs, are for Jenkins Check, Globe, and Angle Valves. Two have guide disc nuts. One, at extreme right, is fitted with throttling nut.

Now, when *continuous valve efficiency* is vital . . . you can rely on readily available Jenkins Renewable Composition Discs to provide the valve protection that greatly extends service life. Proper disc selection and replacement in time guard against premature wear, can multiply the original efficiency of valves many times over.

Disc replacement is simple and easy, can be done without removing valves from the line. To save more time, maintenance-wise valve users keep on hand a stock of disc holders fitted with the discs most commonly used.

Only Jenkins makes *both* Valves and Discs

Originator of the first successful Renewable Composition Disc, Jenkins Bros. has continued to set quality standards. That's why you can rely on your Jenkins Distributor for discs of time-tested design and composition, plus authoritative disc information.

Ask your Jenkins Distributor for the folder, "A Guide to Correct Disc Selection" . . . also the "Jenkins Disc Selector", a handy wall chart listing recommended discs for all common services, temperatures, and pressures. Or write Jenkins Bros., 100 Park Ave., New York 17. Jenkins Bros., Ltd., Montreal.

Money-saving idea for disc-valve maintenance

Keep on hand a stock of disc holders fitted with the discs most commonly used. This permits quick replacements, saves valuable time.

Slip off the disc holder with the old disc, and slip on another containing the new disc.
When you have time, reload the old disc holder with a new disc.

Sold through leading Industrial Distributors everywhere

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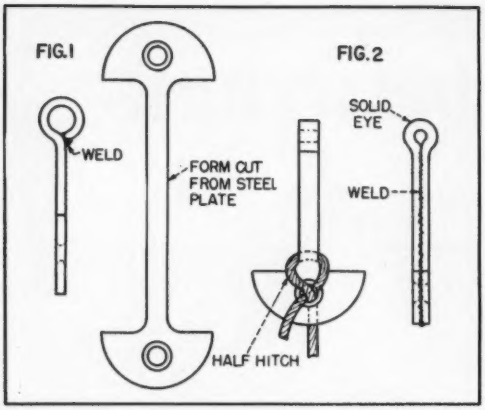
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864 TRADE JENKINS MARK

Jenkins Bros

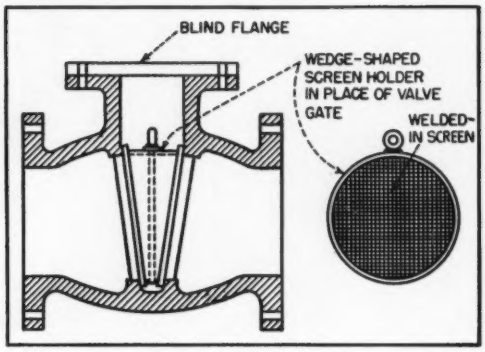
Cat's Paw Attachment for Scraper Ropes



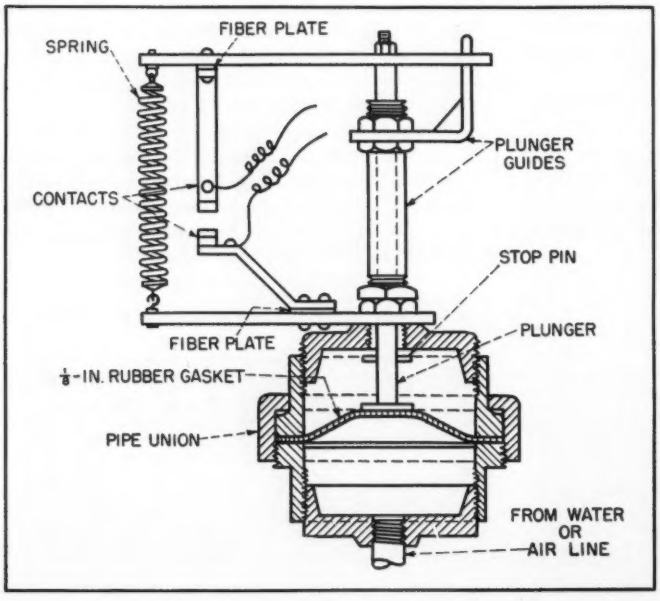
Much time is saved in the attachment of ropes to scrapers with the cat's paw device shown here which was devised at the Richmond property of the Mountain Copper Co., Ltd., Matheson, Calif., where large scrapers are used to move ore to transfer and loading points. With this device, ropes can be attached to the scraper with a simple half-hitch instead of clamps or other attachment auxiliaries. Originally the units were made of ¾-in. steel plate as shown in Fig. 1. However on several occasions the weld of the eye failed, and consequently the improved design, Fig. 2, was employed. The eye in the new design is solid as shown, and is formed by bending the cat's paw steel cut-out around a steel pin with the aid of applied heat. The side seams are then welded together.

Strainer for Pump Suction

This shop-built strainer was inserted in the suction line of centrifugal pumps when the river from which the pumps drew water was excessively muddy during flood stages. An old gate valve, somewhat larger than the suction line, was used for the body of the screen to prevent excessive resistance to the flow of water in the line. The gate valve was taken apart, and the gate assembly removed. A wedge-shaped piece of pipe with a circular screen spot-welded in the center was made and placed between the valve seats. The top flange of the valve was then covered with a blind plate as shown. When the flow of the river subsided, and the water cleared up, the screen was removed from the valve. Time required for removal was only a few minutes.



Alarm for Water Lines



This inexpensive automatic alarm will be found dependable and effective on water pressure lines leading to tanks, cooling jackets of engines and chambers, and water storage equipment where a pump is likely to become unprimed. The device consists of a standard pipe union with end lips cut off to accommodate a ⅛-in. rubber gasket; end plugs for pipe union with openings for water line and plunger guide; plunger with stop pin; two strap-iron supports for copper contacts; and a tension spring. The upper contact which is bolted to the end of the plunger moves up and down with the plunger. Movement of the plunger brought about by rise or drop in water pressure opens or closes the electric circuit. The device will work with equal effectiveness on air and gas lines.

The DorrClone* (Dutch State Mines Cyclone) is a compact classification unit employing centrifugal force in place of gravity. It provides a new solution to the old problem of support in underground openings . . . efficiently and economically. Keynote to DorrClone operation is the shearing force developed by centrifugal action. This force destroys flocculation in the feed pulp . . . results in efficient classification in the 20 micron to 150 mesh range.

DorrClones . . . can operate either as open circuit classification units or in a two-stage system depending on local conditions. In either case a clean, deslimed sand is produced. Automatic density controls insure a continuous flow of sand having the necessary percolation rate.

DorrClones . . . are extremely flexible. For example, one installation now in operation deslimes at the mill with one DorrClone—repulps the clean sand discharge to 45-50% solids and pumps it to the mine—then a second DorrClone located at the point where fill is to be placed thickens it to 68-70% solids.

Better Tools TODAY to meet tomorrow's demand

Regardless of your particular mining operation, tailings composition or fill requirements, the DorrClone is an ideal tool with which to solve backfill problems. Inquiries should be addressed to The Dorr Company, Engineers, Barry Place, Stamford, Conn. or, in Canada, to The Dorr Company, Engineers, 80 Richmond Street West, Toronto 1.

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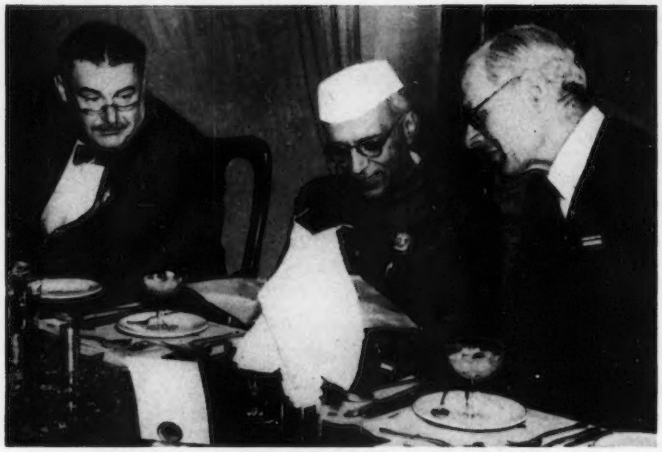
PERSONAL NEWS



AMONG THOSE PRESENT at luncheon at the New Delhi Gymkhana Club marking the close of the celebration of the Centenary of the Geological Survey of India were: Dr. W. D. Johnston, Jr., U.S. Geological Survey, delegate representing the U.S. Government and the Geological Society of America (left), the Honorable Shri Jawaharlal Nehru, Prime Minister of India (center), and Sir Lewis L. Fermor, former director of the Geological Survey of India and president of the Institution of Mining & Metallurgy of London.

R. L. McCann, formerly vice president of The New Jersey Zinc Co., was elected president at a meeting of the board of directors in February. He succeeds **Henry Hardenbergh,** who was elected chairman of the board. Mr. McCann, who was formerly general manager of mines, was appointed assistant to the president in January, 1949, and vice president in March, 1950. Other officers of the company were re-elected.

ARTHUR P. CORTELYOU has been appointed general manager of United States Vanadium Co., a division of Union Carbide & Carbon Corp. His headquarters will be in New York. Mr. Cortelyou, who received his B.S. in mining at the University of California, has been identified with Union Carbide's mining activties both as engineer and executive since 1930.

The annual dinner and meeting of the Engineers Club of Northern Minnesota was held at Hibbing Feb. 24. Officers elected for 1951 are: **W. P. Wolff,** chief mining engineer for Oliver Iron Mining Co. in the Hibbing-Chisholm district, president; **T. C. Thielman,** superintendent of the Embarrass mine, Pickands, Mather & Co., vice president; **Hugh L. Leach,** superintendent of the Hill-Trumbull mine of Cleveland-Cliffs Iron Co., secretary.

Russell Thomas has been made underground foreman at Oliver Iron Mining Co.'s Soudan mine on the Vermilion range.

Clarence Sleeman, engineer at the Hill-Annex mine of the Inter-State Iron Co., has been transferred to the company's general office at Virginia as assistant chief engineer. **Howard Caddy** is chief engineer for Inter-State.

J. L. Strong, mining engineer with Oliver Iron Mining Co. in Duluth, retired Feb. 1. He had been with Oliver since 1908.

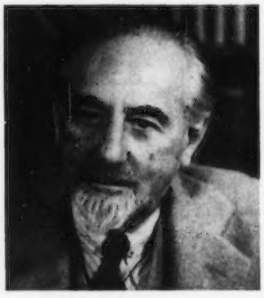
Prof. T. L. Joseph, assistant dean of the Institute of Technology, University of Minnesota, has been elected chairman of the Iron and Steel Division of the American Institute of Mining & Metallurgical Engineers. He automatically becomes a director of the Institute.

Dr. Ralph Marsden, geologist for Jones & Laughlin Steel Co., and **Dr. Vincent McKelvey** of the U. S. Geological Survey, addressed the University of Wisconsin department of geology graduate group in February. They spoke, respectively, on "Iron Ore Reserves of the World" and "Geotectonics and Mineral Deposits."

Walter A. Hamilton, formerly mill superintendent for Rosiclare Lead & Fluorspar Co., Rosiclare, Ill., is now mill superintendent for the St. Louis Smelting & Refining Division of National Lead Co. He can be addressed at 306 South Main St., Fredericktown, Mo.

H. DANFORTH STARR, assistant to the president of Cerro de Pasco Copper Corp., has been elected to a newly created office of vice president. He will supervise financial and accounting functions of the corporation.

Richard W. Maki, engineer, has joined the construction department of Jones & Laughlin Ore Co. at Negaunee, Mich., and is employed as an intrument man at the Tracy mine.



JOHN VAN NOSTRAND DORR, chairman of the board of directors of The Dorr Co., has been made a member of the Legion of Honor of the American Institute of Mining & Metallurgical Engineers in recognition of his 50 years of service as a member. The citation took place Feb. 21 in St. Louis at the annual meeting of the Institute.

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Any business—large or small—may now use a DO rating to obtain limited quantities of steel for maintenance, repairs and minor capital additions. The rating to apply is DO-97 as authorized by the NPA's new Regulation No. 4.

Obviously the use of this rating does not automatically get the steel because it is impossible to maintain complete stocks under present conditions. However, it does assure your order of preference over unrated orders and equal treatment with all other orders bearing a priority rating. If we have the steel you get it. Moreover, we can in turn extend the rating which should help us to maintain stocks for your future needs.

Because of broken stocks, we suggest you give us alternate sizes, gauges and qualities that would be acceptable. In this way you increase the chances of getting steel you will be able to use.

And remember, if your order falls within the provisions of Regulation No. 4 take advantage of it—use your rating! You can be sure that we will make every effort to take care of you as promptly and fully as possible.

If you do not have this Regulation No. 4 we will be glad to send you a copy.

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Richard Marsten, assistant superintendent of Inland Steel Co.'s Morris mine at Ishpeming, has been spending some time at Inland's new Cayia mine near Crystal Falls superintending the preliminary development work.

C. T. Hill has been elected a vice president of Texas Gulf Sulphur Co., according to a recent announcement by **Walter H. Aldridge**, president.

DR. JOHN F. THOMPSON, president of the International Company of Canada, Ltd., was elected to the additional office of chairman of the board of directors. He succeeds the late Robert C. Stanley. Dr. Thompson joined the company in 1906. In 1918 he established and became manager of the first technical department, and in 1921 was made manager of operations. Since 1928 he has served successively as assistant to the president, a director and member of the executive committee, executive vice president and a member of the advisory committee. Dr. Thompson president in February, 1949.

DR. PAUL D. MERICA, executive vice president and a director of the International Nickel Company of Canada, Ltd., has been elected a member of both the executive committee and the advisory committee of the company. After joining the organization in 1919 as director of research, he served as associate manager of the development and research department, assistant to the president, a director and a vice president.

Tom Lyon, formerly with the International Smelting & Refining Co., has taken over the duties of director of the supply division, Defense Minerals Administration. The Division is in charge of ore allocations, programs, planning and other important functions. Mr. Lyon succeeded S. H. Williston, who resigned.

Lynn Hersey, Miami, Ariz., returned recently from a reconnaissance examination trip to Jamaica, B.W.I., where he worked in conjunction with Dr. Chubb, consultant for the British Government and Prof. V. A. Zanz, economic geologist, Geological Survey Dept., Jamaican Government.

James A. Barr, consulting engineer, has been named to head the non-metallics branch of the Defense Minerals Administration in Washington, D.C.

E & M J Salute for Outstanding Service

FRANK W. McQUISTON, JR.

IF YOU WERE TO ASK anyone who knows him what Frank McQuiston's outstanding characteristics are, ten out of ten replies would mention Frank's unfailing cheerfulness and his tremendous capacity for hard work. We're sure of this forecast because these two traits are so evident in everything Frank does.

He has a smile for you, and a polite deference for your opinion, even when he disagrees with you. But don't think you've put him off, or convinced him against his better judgment, just because he's pleasant. Frank has a mind, and a will, of his own. He just has a knack of getting things done smoothly, and he needs all that talent in his present job.

As Deputy Manager of Raw Materials Operations for the Atomic Energy Commission, Frank has to be constantly on the move, getting people to do things, usually things they don't particularly want to do. A dictatorial, or even a hard-driving, impatient man in this job could do infinite harm to this country's atomic energy program. Frank's friendly way of getting the job done smoothly is doing it infinite good.

Born in Pueblo, Colo., Frank followed his family's tradition of mining. Although he graduated from the College of Mines in Berkeley, Calif., in 1931 (of all years to graduate in!), he promptly got a job, with F. W. Bradley at the Spanish mine in California. A year later he went with Empire Star at Grass Valley, Calif., the nicest mining country in the world.

Newmont Mining Co., Empire Star's parent company, didn't leave Frank in peace to enjoy it, however. Until the U. S. entered World War II, Frank was sent everywhere from his Grass Valley base, tackling Newmont's metallurgical problems, usually in flotation and cyanidation.

He pioneered new flowsheets involving recovery of free gold by jigs and amalgamators, or by flotation and cyanidation of concentrates as a means of replacing all-cyanidation techniques. Many of these developments are now standard practice in gold mines.

During the war, McQuiston turned his attention to base metal problems, notably at Resurrection in Colorado, Gray Eagle in California, Bagdad in Arizona, and Idarado in Colorado. The flowsheet he worked out at Idarado for this complex gold, silver, copper, lead and zinc ore is a noteworthy accomplishment of this period.

After the war, Frank returned to gold milling, putting much time in on developing a low-cost method of using activated carbon to recover gold from cyanide solutions. He stayed with the Newmont organization until January, 1948, when he was loaned to the AEC to help organize the Raw Materials Division. Although now doing a full-time job for the AEC, Frank still finds time for other things, for example, several trips to French Morocco as consultant to Soc. des Mines De Zellidja, the large new lead-zinc property in which Newmont has an interest.

That's the only trouble with Frank, after all. He gives too much of himself to his work, and to his industry. He's active in AIME affairs, and he has written numerous papers and articles. He seems always willing to take on another job, if it's worth doing. But for his own sake, and for the sake of the job he does so capably for the atomic energy program, we wish he'd slow down. Knowing Frank, we expect him to smile at this remark, agree that he'll "certainly try to," and keep right on going.

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AWARDS FOR OUTSTANDING PAPERS presented by students at the annual meeting of the American Institute of Mining & Metallurgical Engineers on Feb. 19, were made by Willis Peirce (extreme right), president. Shown receiving these awards are: (left to right), R. E. Bish, Pittsburgh; W. P. Chernock, Chicago, and C. E. Lundin, Chicago.

OBITUARIES

BRENT N. RICKARD, who retired July 1, 1950, after 40 years' service with American Smelting & Refining Co., died March 8 in Tucson, Ariz. He joined the company in 1905 as assayer and chemist at the Monterrey, Mex., plant. A year later he resigned, but returned in 1910 and held various important positions at many of AS&R's smelting and refining units until his retirement.

Ing. Thomas Barrera Arenas, 58, chief of the mines department of Cia. Fundidora, S.A., Monterrey, Nuevo Leon, died of a heart attack on Feb. 22, while on business in Mexico City.

Charles J. Stone, 82, retired mining engineer and petroleum geologist, died Feb. 18 at Seattle. He managed various Montana mines before joining the Sharples Corp. as mining engineer where he remained for 18 years School of Mines he spent many years until his retirement five years ago.

James Hall Watson, 90, pioneer civil and mining engineer of Seattle, died Feb. 12. He worked as first inspector of mines in the Territory of Washington, and also as a field engineer in Alaska for the Alaska Road Commission.

Clarence Woods, retired mining engineer, died recently in Los Angeles. A graduate of the Missouri School of Mine, he spent many years in South America, where he was in charge of the Santo Domingo mine in Peru.

C. Arthur Johnson, 60, superintendent of production, crusher division, Nordberg Manufacturing Co., died while on a visit to Mission Tex., on Feb. 18.

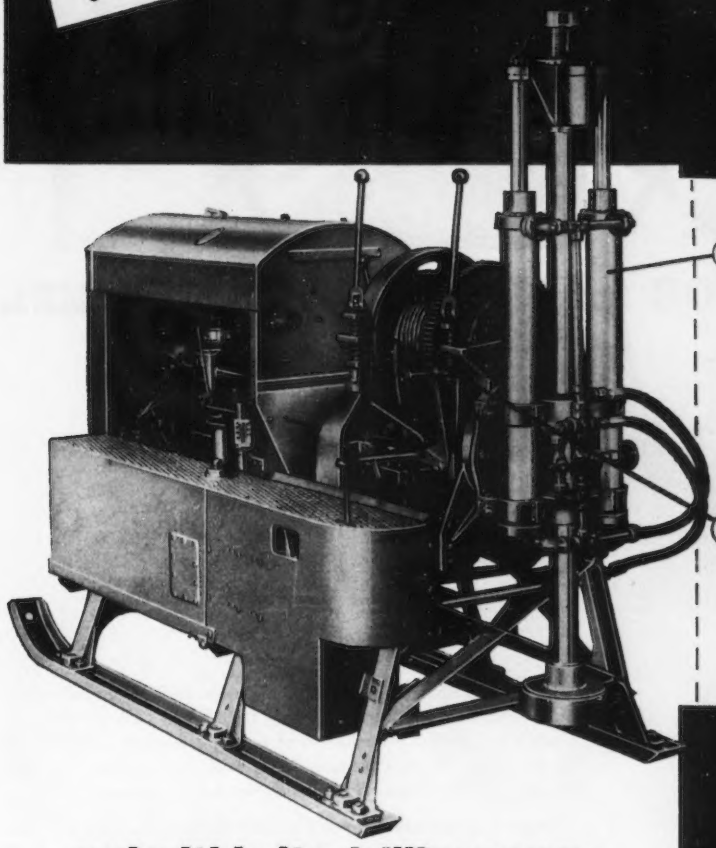
Robert W. Moffat, refinery casting shift boss at Kennecott Copper Corp.'s new Garfield refinery, died Feb. 21 in Salt Lake City from burns received during a refinery accident. He was 30 years old, the son of D. D. Moffat, former vice president and general manager of Utah Copper Co.

Sam A. Lewisohn, president of Miami Copper Co. and chairman of the board of the Tennessee Corp., died of a heart attack March 14 while vacationing at Santa Barbara, Calif. He was a noted industrialist, philanthropist, art patron and author.

Dr. Charles E. Lucke, 74, who headed the department of mechanical engineering at Columbia University for 34 years until his retirement in 1941, died March 25 in New York.

William G. Mather, 93, former president and later chairman of the board of Cleveland-Cliffs Iron Co., died in Cleveland, Ohio, April 5.

NOW



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1 NEW 12AH SWIVELHEAD

. . . a light twin cylinder hydraulic swivelhead for use with "A" or "B" equipment (I.D. of drive tube, $2\frac{1}{16}$"). It combines high speed with operating economy and minimum weight—2560 lbs. as illustrated.

2 NEW HEAVY-DUTY HOIST

. . . for trouble-free hoisting and lowering, a new large size hoist equipped with self-energizing air cooled friction brake—fully efficient to maximum capacity of the drill.

HERE'S WHAT BBS-2 DOES FOR YOU

. . . offers choice of 5 alternative swivelheads, gear, hydraulic or friction for use with "E" to "H"—($3\frac{1}{2}$") rods. Holes from $1\frac{1}{2}$" to 12". BBS-2 is equally adaptable to diamond, shot or rotary drilling . . . ideal for a wide range of programs including prospecting, foundation testing, waterwells, blastholes, etc.

CAPACITIES:
"E" rods: 2400 ft.—$\frac{7}{8}$" core.
"B" rods: 1500 ft.—$1\frac{5}{8}$" core.
"N" rods: 1300 ft.—$2\frac{1}{8}$" core.
"H" rods: 900 ft.—$2\frac{3}{4}$" core.

POWER: 70 H.P. Gasoline or Diesel.

An increasing number of our diesel powered units are giving highly satisfactory performance in the field.

and within its drilling range BBS-2 remains

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- ✔ most economical

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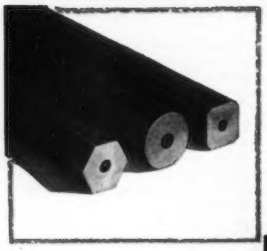

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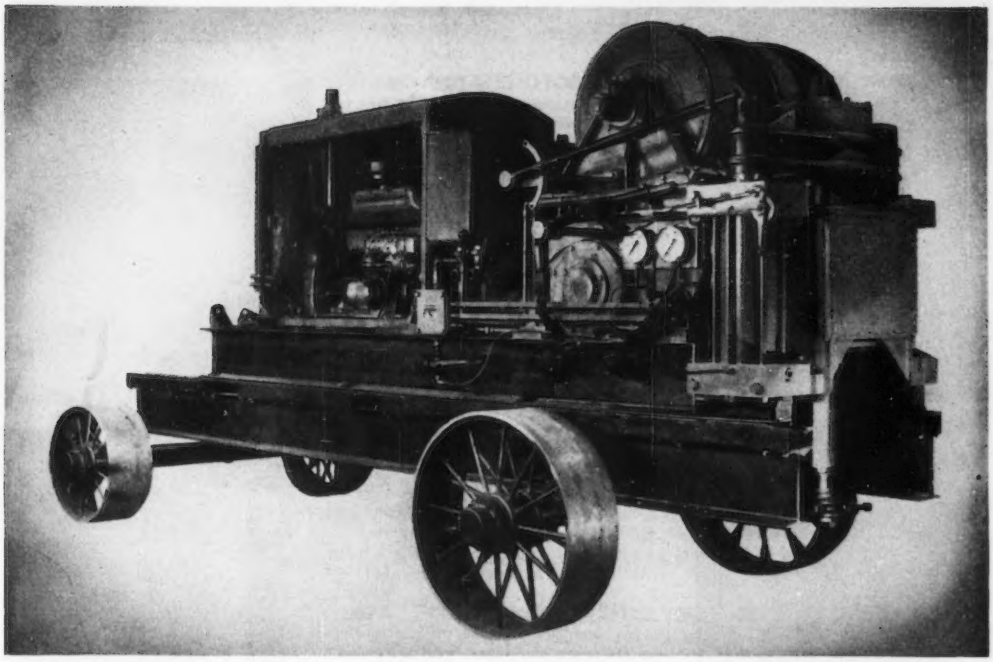
NEW PRODUCTS DIGEST

For further information on these products, circle item numbers on card—insert and mail.

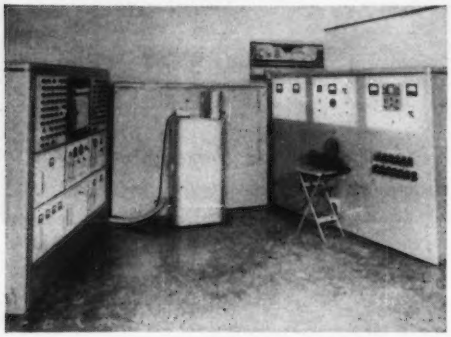


Diamond-Drill Machine Can Put Down 12,000-Ft. Holes

A RECENT South African news item referred briefly to a diamond drill machine designed for very deep drilling. We asked Joe Lawless, McGraw-Hill World News reporter in Johannesburg, to run the item down. He in turn contacted the Joy-Sullivan company in South Africa which made the improved No. 50 core drill shown above, and offered the following additional information:

"Two of these machines were built for the N'Kana copper mine in Northern Rhodesia. South African manufacture was undertaken because of devaluation and the shortage of dollars. We have successfully manufactured this machine at a cost to our South African customer equal to the pre-devaluation imported price. To save dollars this unit has been constructed with a British Leyland 6-cylinder diesel engine instead of the usual Caterpillar engine which is built into the machines which were imported from our parent company, the Joy Manufacturing Co. of the United States.

"This machine is capable of drilling to a depth of 12,000 ft. with BX diamond drill bits." (1)



DIRECT READING SPECTROMETER for almost instantaneous analysis of all metals is announced by Applied Research Laboratories, Glendale, Calif. Analyzes quantatively up to 20 elements simultaneously. (2)

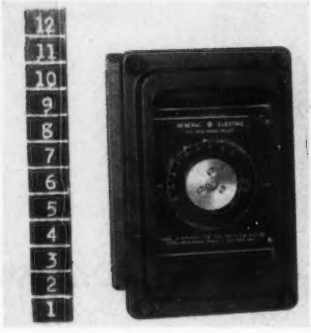
VALVES for actuating hydraulic or air cylinders, introduced by Ledeen Manufacturing Co., Los Angeles 15, Calif., are made for hand, foot, or finger operation. Valve is of rotating disk construction. Solenoid-operated type is also available. (3)

TRACTO-LOADER with ¾-yd. bucket handles load with hydraulic control system. Unit is made by Tractomotive Corp., Deerfield, Ill., and sold exclusively through Allis-Chalmers Industrial tractor dealers. Gasoline engine is 40.5 hp. (4)

INSECTICIDE for killing cockroaches in mines and beaneries, and bedbugs in bunk-houses is announced by Yosemite Chemical Co., San Francisco, Calif. Dry aerosol bomb containing "Dispercide" space-kills bugs. (5)

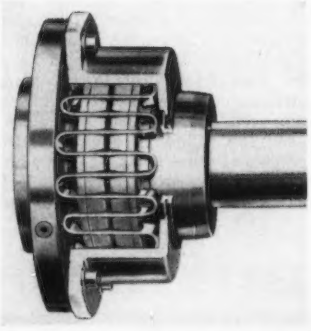
PORTABLE COMPRESSOR, two-stage, Model WM-105, just announced by Gardner-Denver Co., is powered by Hercules Model QDX-5 Hercules gasoline engine. Unit has a capacity of 105 cfm. Air is cooled by a intercooler. (6)

NEW RELAY (TYPE ACR) is designed for use on automatic reclosing equipment with all types of power circuit breakers. Made by General Electric Co., Schenectady, N. Y. Unit may be adjusted for one, two, or three delayed reclosures at chosen intervals. (7)

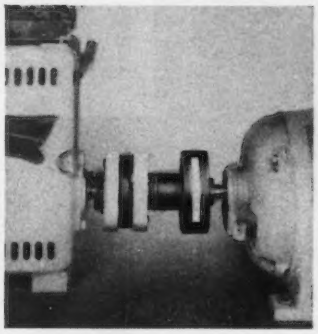


PORTABLE ELECTRIC CONVEYOR for handling all types of forgings, castings, and similar objects. Available in 6, 8, 10 and 12-ft. lengths. Made by Industrial Engineering & Manufacturing Co., Brimfield, Ind. Chain speed is 70 fpm. (8)

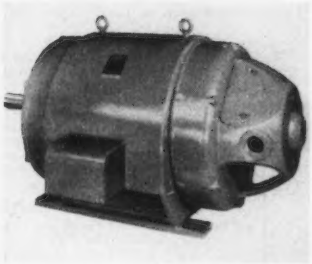
FLEXIBLE COUPLING for horizontal and vertical installations is announced by the Faulk Corp., Milwaukee 8, Wis. New "Steelflex" coupling is designed for installations to support long shaft extension or floating shaft. (9)



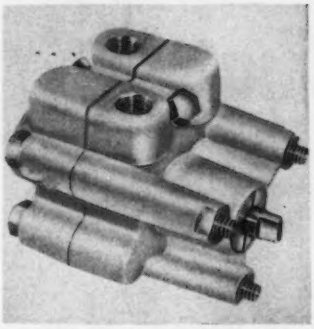
HUMIDIFIER vaporizes 1 gal. of water per min., and requires about ¼ hp. Vapor is emitted in extremely fine mist. Unit is called "IMPSCO" humidifier made by Industrial Materials Purchasers Co., New York, N. Y. (10)



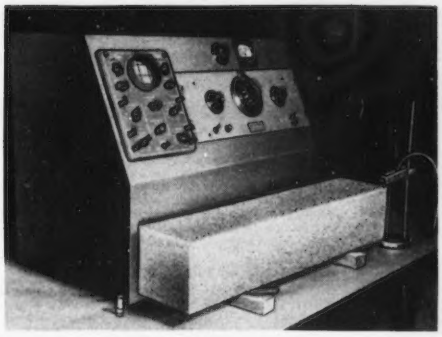
MERCURY CLUTCH COUPLING is designed for installations on shafts of integral horsepower electric motors up to 15-hp. rating. Unit is made by Automatic Steel Products, Inc., Canton 6, Ohio. Clutch can be mounted on standard flexible couplings. (11)



HEAVY-DUTY MOTOR with wound rotor provides variable speed drive and high starting torque. Built in ratings from 30 to 1,500 hp. by Electric Machinery Manufacturing Co., Minneapolis, Minn. Splash-proof models are also available. (12)

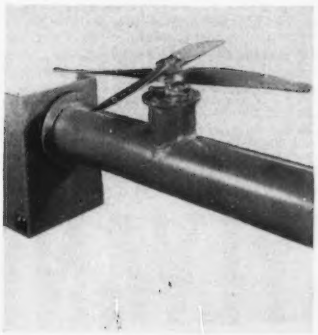


COMPACT PUMP, only 3 3/16 in. long handles 1.65 gpm. at pressures up to 150 psi. New M-3 model made by Eco Engineering Co., Newark, N. J., is constructed of bronze forgings which will withstand many types of corrosion. (13)

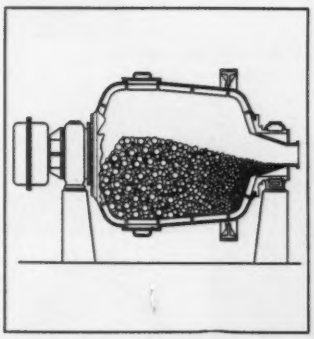


ELECTRO-SONOMETER measures modulus of elasticity of aluminum, castings, ceramics, concrete, steel beams by sonic methods. Laboratory and semi-portable models made by Electro Products Laboratories, Chicago 40, Ill. (14)

EASY-POUR TILTER for pouring liquids and reagents from cans into small containers is manufactured by General Scientific Equipment Co., Philadelphia 32, Pa. Cradle is made of steel and fits any standard 5-gal. can. (15)



EXHAUST FAN for handling sulphuric acid fumes in steel mills or metallurgical plants. Fan is made of No. 20 stainless alloy by Carpenter Steel Co., Union, N. J. This alloy withstands sulphuric acid attack at temperatures up to 176° F. (16)

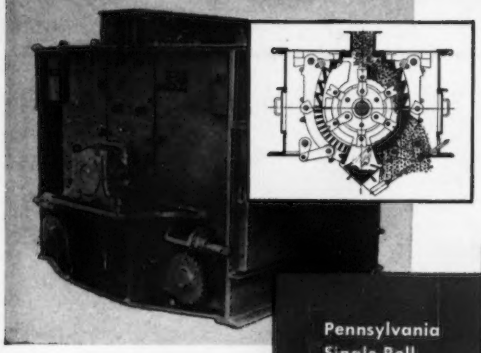


NEW TRICONE MILL, recently introduced by Hardinge Co., Inc., York, Pa., features a tapered shape which keeps the larger grinding balls on the feed end of the mill. Advantages are higher efficiency and less wear on grate. (17)

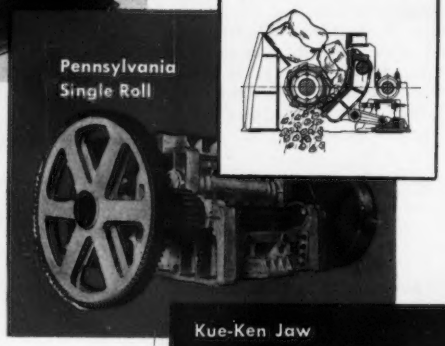
why Pennsylvania makes many types of crushers

In the mining industries crushing problems are seldom, if ever, identical because there are variables such as product, feed size, capacity, moisture content, and physical and chemical structures of material—*and no one type of crusher can meet all of them.* That's why Pennsylvania has a large and varied line, a portion of which is illustrated here. In this line there is a type of crusher adapted to deal with each individual job no matter what it may be, and since our engineers are not limited to only one or two types when making a recommendation, you can be assured there is no bias or prejudice in favor of a specific crusher. This is one of the very good reasons to at least get Pennsylvania's counsel on every crushing job. Even if you aren't ready for a new crusher we'll be glad to check your operation and report on its efficiency. This could well be the first step towards reducing your operation costs.

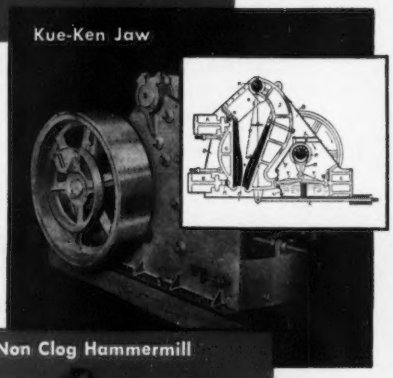
Pennsylvania Reversible Hammermill



Pennsylvania Single Roll

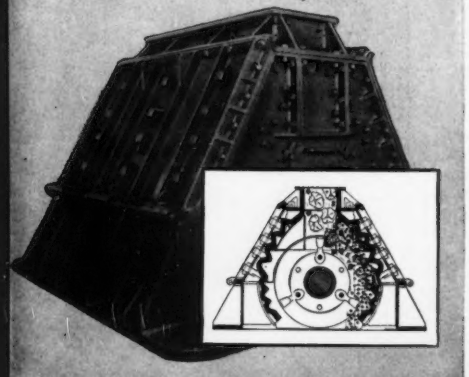


Kue-Ken Jaw



Dixie Non Clog Hammermill

Pennsylvania Reversible Impactor



What type of crusher do YOU use?

REVERSIBLE HAMMERMILL

The Pennsylvania Reversible Hammermill with 2 Zone Crushing and Adjustable Cage offers great economy in operation and maintenance while producing a coarse or medium fine product without using a closed circuit system. The Reversible feature virtually makes this machine two crushers in one. Press a button—today clockwise—tomorrow, counter clockwise. Send for Bulletin 1034.

SINGLE ROLL

Requiring surprisingly little headroom, Pennsylvania Single Roll Crushers are powerful machines that have big hourly capacities at low cost per ton and can handle wet, sticky and frozen materials without choking or jamming. Massive Breaker Plate is easily adjustable to or from the Crushing Roll. This permits product size change at any time and also compensates for gradual wear of working parts. Send for Bulletin 2011.

KUE-KEN JAW CRUSHER

The improved design of the Kue-Ken Jaw Crusher, using the "crushing without rubbing" principle, is the one great advancement in jaw crushers in many years. It replaces the old, poorly lubricated, slow speed, unavoidably heavy machine that gave operators a low opinion of the jaw. The Kue-Ken gives you — 2 to 5 times greater capacity, 5 to 10 times longer jaw plate life, much lower power requirement, a completely enclosed oil bath lubrication with clean, constantly filtered oil, and other features that put the Kue-Ken way out in front. Send for Bulletin 5011.

DIXIE NON-CLOG HAMMERMILL

Wherever sticky, wet materials may be encountered, there the Dixie Non-Clog Hammermill is without parallel in efficiency. The moving, extended Breaker Plate keeps the most difficult mucky feeds from choking the mill, holding production at peak capacity. The crushing is done *on* the numerous moving Breaker Plates, therefore wear is distributed over a large area, prolonging plate life, thus reducing maintenance cost.

REVERSIBLE IMPACTOR

The Pennsylvania Reversible Impactor reduces by direct impact at controlled slow speeds, producing cubed particles uniform in size. Reduction ratio is quite large, a reduction of minus 10" feed to ½" in one operation is not unusual (closed circuited with external screening or separating equipment). This is an ideal crusher for high silicas and abrasive rocks, clinkers, minerals and chemicals. The Reversible Rotation feature doubles the life of principal working parts. Send for Bulletin 6016.

PENNSYLVANIA CRUSHER COMPANY • *Division of Bath Iron Works Corporation* • 1712 Liberty Trust Bldg., Philadelphia 7, Pa.

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Single Roll Crushers • Reversible Impactors • Reversible Hammermills • Ring-Type Granulators • Bradmills • Bradford Hammermills • Kue-Ken Jaws • Kue-Ken Gyraconas • Dixie Non-Clog Hammermills • Dixie Feed Mills and Process Grinders

PENNSYLVANIA CRUSHER COMPANY

PENNSYLVANIA CRUSHERS

Equipment Shorts

FACESHIELDS. A new line of faceshields, offering greater user economy through a choice of specific visors for specific hazards has been introduced by Mine Safety Appliances Co., Pittsburgh, Pa. "Chempruf" visors are built to guard the face, eyes and neck against chemical splash, and "Chipruf" visors offer protection against flying particles. Both visors are interchangeable on the MSA "Headline" headgear. (31)

FLEXIBLE COUPLINGS. Link-Belt Co., Chicago, Ill., describes a line of "RC" flexible couplings which consist of two tooth sprockets or coupling halves joined by a peripheral strand of roller chain. These couplings will withstand parallel shaft misalignment of as much as 1/64-in. or 1.5-deg. angular misalignment. Coupling bore for this line ranges from ⅝ to 12 in. (32)

PLUG-IN CIRCUIT BREAKER. A new type of plug-in circuit breaker for 15 to 50-amp. service featuring quick-made quick-break operation and thermal-magnetic protection has been introduced by Trumbull Electric Manufacturing Co., Plainville, Conn. (33)

ELECTRIC WELDER. Two new power units designed for the Nelweld gun-type stud welder for construction jobs are announced by Nelson Stud Welding Division of Morton Gregory Corp., Lorain, Ohio. One is called the Nelwelder Power unit which is fused for 200 amp. starting load and operates on 60 cycle, 220 or 440 v. ac. The other called the Nelwelder Battery unit is powered by twelve 150-amp. storage batteries. (34)

PRINTING CALCULATOR. Remington Rand, New York 10, N. Y., announces a new printing calculator with 10 numbered keys for the speedy performance of most complex computations. Addition, subtraction, division, and multiplication problems can be performed speedily, and the computations as well as the answers are printed on a tape for reference. (35)

HEAVY-DUTY AIR HOSE. A loom-braided heavy-duty air hose suitable for rugged service in mines is offered by National Hose-Metal Hose & Tubing Co., Dover, N. J. The hose consists of several layers of loomed and braided plies of high-tensile yarns interlaid with friction compounds. The neoprene cover is tough and abrasion resistant. Inside diameters range from ¾ to 1¼ in., working pressures from 175 to 250 lb. (36)

HIGH-CONDUCTIVITY CONCRETE. A new type of concrete consisting of aggregates blended to increase the heat conductivity of concrete is described by Products Planning Co., Pittsburgh, Pa. Radiant heating installations can save as much as 25 to 30% with this concrete. (38)

PERLITE CURTAIN WALL. Great Lakes Carbon Corp. announces that a new 6-in. perlite curtain wall has recently received a 4-hr. fire rating from the Underwriters' Laboratories, Inc. The wall consists of an exterior layer of Permalite/portland cement plaster or concrete 4 in. thick, and an interior layer of Permalite/gypsum plaster 1 in. thick, separated by a furring channel. (39)

PROTECTIVE PLASTIC COATING. A new air-drying plastic protective coating used to protect tanks, tank cars, pipes, fittings, structural steel parts and chemical processing equipment against splash, drip and spray from corrosive chemicals, corrosive atmospheres, weathering and rust has been developed by United States Rubber Co. The plastic combines flexibility with good adhesion, and will not chip or crack on steel, aluminum, concrete, hardwood, or composition board. Here's a product for smeltermen and hydrometallurgists to watch particularly because of the corrosive fumes and vapors involved in these fields. The new coating is in the pilot-plant production stage, and will be marketed by the mechanical goods division under the trade name U. S. Royalguard protective coating. (40)

PORTABLE CONVEYOR. A newly developed portable conveyor Model 366 is announced by Barber-Greene Co., Aurora, Ill. The new conveyor is mounted on rubber-tired wheels, carries a 24-in. belt, is 20 ft. long and weighs 1,600 lb. It is designed especially to go with the modern continuous mining equipment now making its advent in the mining industry. (37)

USE THIS CONVENIENT CARD

to obtain further information on products and bulletins mentioned in the New Products Digest. Circle item numbers, tear out and mail.

Not good after July 1, 1951, if mailed in U. S. or Canada.

NOT GOOD AFTER JULY 1, 1951—If mailed in U. S. or Canada — April, 1951

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	8	15	31	38	45	71	78	85
2	9	16	32	39	46	72	79	86
3	10	17	33	40	47	73	80	87
4	11	18	34	41	48	74	81	88
5	12	19	35	42	49	75	82	89
6	13	20	36	43	50	76	83	90
7	14	21	37	44	51	77	84	91

My Name ..... Position .....

Company .....

Address .....

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

LABORATORY CRUSHERS. A 6-page illustrated pamphlet covering the line of laboratory, rolling-ring, and swing-hammer crushers; grinders; and shredders made by American Pulverizer Co., St. Louis, Mo. Blueprints and specifications accompany the descriptions. (71)

STRIPPING SHOVELS AND DRAGLINES. Some of the world's largest stripping shovels and walking-type draglines are shown in action in this 28-page Bulletin No. STR-1 released by Bucyrus Erie Co., Milwaukee, Wis. Condensed specifications are included for the 550-B shovel with largest dipper 22 cu. yd.; the 1050-B shovel with largest dipper 36 cu. yd.; the 650-B dragline with largest bucket 16 cu. yd. and boom-length 175 ft.; and the 1250-B dragline with largest bucket 30 yd. and boom length of 200 ft. (72)

RETAINING WALLS. This 16-page booklet is really a manual for construction of retaining walls with Armco bin-type steel retaining-wall columns, stringers, and joints, manufactured by Armco Drainage and Metal Products, Inc., Middletown, Ohio. These steel sections can be used to construct cribbing at mining properties. (73)

AIR VALVE. A six-page folder describing and illustrating the Electroaire valve, a complete air-control unit consisting of 4-way directional valve, solenoid controls, and independent speed regulators for control of piston-rod speeds of air cylinders. Released by the Bellows Co., Akron 9, Ohio. (74)

GEIGER COUNTERS. Illustrated price list of Geiger counters, Geiger tubes and accessories, scalers and accessories released by Tracerlab, Boston 10, Mass. Twelve different types of Geiger counters and survey meters are listed. (75)

HYDRAULIC PULLERS AND JACKS. Labor-saving applications of hydraulic pullers and jacks are discussed in a new 8-page bulletin, Hydraulic 51, issued by Templeton, Kenly and Co., Chicago, Ill. (76)

Here's Some Help on Bearing Maintenance

A continuing study of bearing maintenance techniques and successful maintenance, installation, and removal procedures is being published in pamphlet form by The Anti-Friction Bearing Distributors Association. A file folder type of binder is being sent to each bearing-user who requests it on company letterhead. It can be used for compiling succeeding issues.

Address your request for this service to the Association at 1900 Euclid Ave., Cleveland 15, Ohio.

SMALL DIESEL ENGINES. New bulletin released by Nordberg Manufacturing Co., Milwaukee, Wis., describes and illustrates the Type 4S, one and two-cylinder, 4½x5½-in. diesel engines which are rated from 10 to 30 hp. at 1,200 to 1,800 rpm. (77)

LARGE DIESEL-ELECTRIC SET. Four diesel electric sets ranging from 314-kw. to 165-kw. rated output are illustrated in Caterpillar Tractor Co.'s new 16-page booklet, Form 30059. Operating parts and assemblies of the units are shown in excellent cut-away drawings and photographs. (78)

SEAMLESS WELDED FITTINGS. A dimensional data card is offered by Taylor Forge & Pipe Co., Chicago, Ill., which gives essential dimensions for Taylor Forge ells, tees, reducers, and flanges. (79)

DUCKBILL-SHAKER CONVEYOR. Goodman Manufacturing Co., Chicago, Ill., has just released five related bulletins on their Duckbill-Shaker Conveyor, Type G Shaker Drive, Type E-11 Shaker Drive, Automatic Duckbill, and Complementary and Accessory Equipment. This equipment is suitable for application in coal, metal and non-metallic mining operations. (81)

SAFE MINE SUPPLIES. This is the title of a booklet released by J. V. Hammond Co., Spangler, Pa., which describes and illustrates explosives boxes, wood tamping poles, sectional tamping poles, trolley poles, brake blocks for mine cars, wooden mallets and wedges, safety car holders, wooden roof pins or bolts, and other equipment. (82)

DIESEL POWER. Applications of diesel engines in hauling, loading, crushing and pulverizing, sand and gravel dredging equipment are illustrated in an 8-page bulletin released by Cummins Engine Co., Inc., Columbus, Ind. (83)

TRACTOR COMICS. A four-color operator's handbook printed in comic book style and prepared especially for heavy equipment operators is now being distributed by Caterpillar Tractor Co. to its dealers and customers. It is neat, instructive and interesting—even if you are not a comic-book fan. The "do's and don't's" sections are well done. (84)

PLANNED LIGHTING FOR INDUSTRY. This is the title of an excellent 47-page booklet prepared by Engineering Division, Lamp Department of General Electric Co., Cleveland 12, Ohio. Elements of good lighting systems are covered in complete detail, and the mine and mill plant manager will find many useful suggestions offered here. (87)

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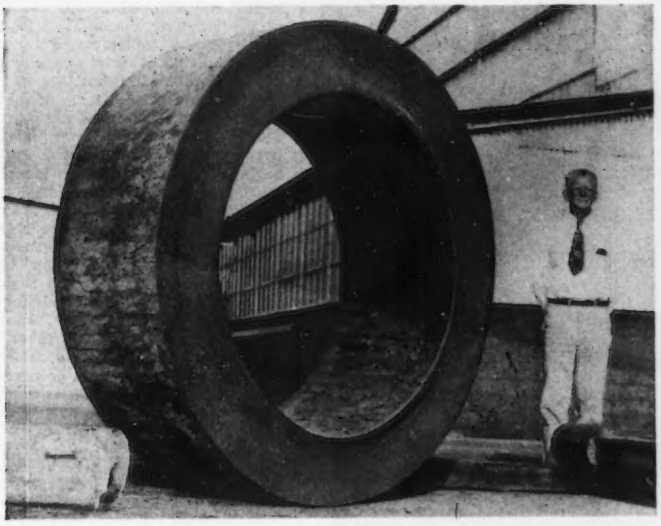

• Giant 19,000-lb. chromium-nickel-molybdenum-steel forging was made at the Torrence, Calif., plant of National Supply Co. It will be shipped with others of equal size to be used on the crushing rolls of Inspiration Consolidated Copper Co., Inspiration, Ariz.

Memos from the Manufacturers

• **Carboloy, Inc., affiliate of General Electric Co., has** launched a $2.8 million plant expansion program at Detroit, Mich., to meet rapidly increasing war demands for tungsten carbides in various forms.

• **Elmco Corp. has purchased the main locomotive repair shops** of the Denver & Rio Grande Western Railroad in Salt Lake City. This additional plant space will be used to manufacture filtration equipment, ball mills, folding scrapers and diesel mine locomotives.

Joy Mfg. Co.: Frederick W. Thomas of Cranford, N. J., appointed director of purchases; George R. Fox becomes assistant vice president in charge of the company's plant expansion program.

American Optical Co.: John T. Monahan named assistant sales manager of the safety products division.

Ohio Brass Co.: Appointment of Kenneth Benson as district manager of the mining fields in the Pittsburgh area announced.

Independent Pneumatic Tool Co.: John B. Dempsey named manager of Detroit branch; Robert G. Faverty appointed managing director of Armstrong-Whitworth & Co., Pneumatic Tools, Ltd.; Edward W. Krantz appointed Pittsburgh manager; William J. McGraw named manager of New York branch; Clarence B. Bergren is now Cleveland branch manager.

Kennametal, Inc.: Harry Brandvik appointed representative at new district office in the Metropolitan Bldg., Minneapolis.

Automatic Steel Products, Inc.: A. R. Wise, vice president and sales manager of The Cleveland Tapping Machine Co., a subsidiary, appointed assistant general manager.

Dravo Corp.: John W. Oehler named sales manager of Engineering Works Division.

Roots-Connersville Blower Corp.: Robert H. Owens elected president and general manager, succeeding the late John Avery, who died Jan. 13; Ralph R. Newquist elected executive vice president.

Atlas Steels, Ltd.: H. George De Young appointed works manager.

Allis-Chalmers Mfg. Co.: W. A. Roberts elected president to succeed the late Walter Geist; W. C. Johnson named executive vice president; R. S. Stevenson named vice president in charge of the tractor division.

Nordberg Mfg. Co.: Appointment of Thomas B. McMeekin as sales and service engineer, heavy machinery division, San Francisco office announced.

Hercules Powder Co.: Headquarters in San Francisco moved from 256 Montgomery St. to the Standard Oil Bldg., 225 Bush St.

Link-Belt Co.: Maurice J. Erisman appointed assistant chief engineer for the company's Pershing Road Chicago plant, with headquarters at 300 W. Pershing Rd., Chicago; Homer J. Foye appointed chief engineer at Los Angeles; Charles W. Beauchamp named assistant sales manager, Ewart plant for both silent and roller chain; Merrill Bowman made assistant sales manager, Ewart plant, for Ewart general products.

Worthington Pump & Machinery Corp.: J. J. Llanso appointed general export manager; David S. Gibson appointed assistant to the vice president; William F. Weinreich to be in charge of the newly acquired Oil City (Pa.) plant. He will be assistant to vice president Austin C. Ross; A. William Fraser named Midwest sales manager, with headquarters in Chicago.

Eriez Mfg. Co.: O. F. Merwin elected chairman of the board of directors; R. F. Merwin named president and general manager.

General Electric Co.: Ralph E. Donnelly appointed manager of the Fitchburg (Mass.) Turbine Sales Division; Edwin H. Howell named special representative of Apparatus Dept. in Washington, D. C.; Donald E. Craig named manager of sales of G-E Meted & Instrument Divisions, with headquarters in Lynn, Mass.; Francis K. McCune, assistant general manager of Nucleonics Dept., appointed manager of engineering of the Large Apparatus Division, Schenectady.

The Euclid Road Machinery Co.: Minnesota sales and service branch moved to new building in Hibbing, especially designed for the warehousing of parts and servicing of Euclid equipment. J. W. Bloomquist is manager, D. R. Anderson is in charge of parts, and Otis Hadlock in service manager.

CUT HAULAGE COST

...per YEAR

...per MILE

...per TON!

When EDISON Nickel-Iron-Alkaline Storage Batteries power your mine haulage equipment, they help you cut haulage cost in several ways. Their unequalled dependability gives the closest approach to failure-free, uninterrupted haulage it is possible to obtain. That's because their all-steel cell construction withstands rough usage; their alkaline electrolyte is a preservative of steel; their electrochemical principle of operation is free from self-destructive reactions.

They do not require critical adjustment of charge rates—can often be charged direct from the d-c power supply. They can be fully recharged in six to seven hours, which helps get all charging done during off-peak periods.

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STORAGE BATTERIES

EDISON STORAGE BATTERY DIVISION

of Thomas A. Edison, Incorporated, West Orange, N. J.

In Canada: International Equipment Co., Ltd., Montreal and Toronto

Company Reports *(Continued)*

mined and shipped before the close of the shipping season. The first of five presently contemplated furnaces was completed at Sorel and placed in experimental operation late in the year. The ultimate capacity of the five furnaces is 1,500 tons of ore per day. The ore contains 40% iron and 20% titanium. When commercial operations begin it is expected that the titanium-bearing slag will be sold largely for use in the manufacture of titanium dioxide. Another use will probably be in the production of titanium metal.

The **Utah Copper Division** mined and milled 31,037,800 tons of ore during 1950. A contract was made for the construction of a 7,000-ft. haulage tunnel, 200 ft. below the present bottom outlet of the mine to facilitate haulage as the mine goes deeper. The electrolytic copper refinery at Garfield, Utah, was completed in 1950. Output rate at the end of the year was 12,000 tons per month.

At Chino, tonnage mined and milled totaled 7,347,880 tons in 1950. A major stripping program, under way since 1949, continued, and benches were extended in all directions except to the north. A new unit at the precipitating plant was completed and put in operation, which increases productive capacity at this source by 20%, to 18,000 tons annually. Operation at the **Oswaldo zinc property** resumed in June, 1950. Production for the year was 2,700 tons of zinc. Development of the No. 2 mine was carried on and construction of the surface and underground facilities was completed. This property is now ready to increase zinc production materially in 1951.

Ray Mines Division, Arizona, mined and milled 3,056,425 tons of ore in 1950—1,628,921 from open-pit mining, and 1,427,504 tons by underground mining. Conversion from underground to open-pit methods has progressed to the point that current open-pit output is about 8,000 tons per day. Some remodeling work remains to be done on the No. 2 crushing plant before the mines' full productive capacity of 15,000 tons per day from pit and underground can be reached. This part of the program is expected to be finished by August, 1951.

Braden Copper Division, Chile, mined and milled 8,471,004 tons of ore assaying 2.09% copper in 1950. Smelter output was 315,819,526 lb. of copper. The molybdenite plant has been remodeled, and production increased markedly. Improvements at the **Caletones smelter** included a 30,000-cfm. standby centrifugal blower and a 45-ton overhead crane.

MAGMA COPPER CO. Total tons mined and milled at the **Magma operations,** Superior, Ariz., for 1950 were 423,464. Metal production from the Magma mine for the year included 48,285,474 lb. copper, 517,518 oz. silver, 14,257 oz. gold, and 5,390 tons zinc concentrates.

Exploration results in the **new eastern high-grade copper replacement orebody** discovered 2,000 ft. east of the easternmost ore shoot developed on the main Magma vein (See E&MJ, June, 1950, p. 112) are reported as follows: Drifting in the mineralized bed striking at right angles to the vein at the E. 59⅝ crosscut position was started in 1949 and continued in 1950 for 146 ft. This drift showed the replacement to average 11.6 ft. thick with assays of 4.45% copper, 0.44 oz. silver, and 0.01 oz. gold. Diamond-drill hole 3057-B cutting the beds 40 ft. south of the drift intersected 27.4 ft. of mineralized beds assaying 5.45% copper, 0.88 oz. silver, and 0.02 oz. gold. E. 58½ raise being driven from the 3,000 to the 2,550 level cut 26.8 ft. of the same beds assaying 9.70% copper, 0.95 oz. silver, and 0.02 oz. gold.

The 3,400 level far east drift, also aiming for the eastern orebody, was advanced 1,984 ft. from the E. 31⅛ crosscut position to the E. 54⅜ crosscut position. The last 776 ft. of this advance was on the vein broken with many cross faults. Mineralization so far has been weak and scattered, but 93 ft. in one ore shoot averaged 5.01% copper, 3.05 oz. silver, and 0.03 oz. gold over a width of 7.1 ft.

SAN MANUEL COPPER CORP. Patent was obtained from the United States to 82 lode claims containing 1,458 acres. Mineral rights are owned on 175 acres of this land as the surface had been previously patented to others. San Manuel owns 585 acres of surface only contiguous to the above mining claims. San Manuel has 4 unpatented lode claims, and mineral leases from the State of Arizona covering 135 lode claims and 2,542 acres. (Other details on the progress of San Manuel are reported in E&MJ, Jan., 1951, page 118.) Diamond drilling from the No. 2 shaft 1,475 level, to accurately outline the orebody, has extended the ore limits beyond that used in original reserve estimates. Samples of ore from the No. 2 shaft and adjacent horizontal openings indicate slightly higher copper values than those found in the nearest churn-drill hole.

ST JOSEPH LEAD CO. Production of St. Joe operations for 1950 was as follows:

Product	Tons
Lead concentrates	169,354
Pig lead equivalent of concentrates	110,928
Pig lead produced (incl. lead in purchased concentrates)	141,595
Zinc concentrates	75,290
Sulphuric acid	157,036
Zinc (slab zinc equivalent, incl. zinc in purchased concentrates)	98,443

In Washington County, 30 miles northwest of Bonne Terre, St. Joe has acquired by purchase or holds under optio.1 approximately 3,000

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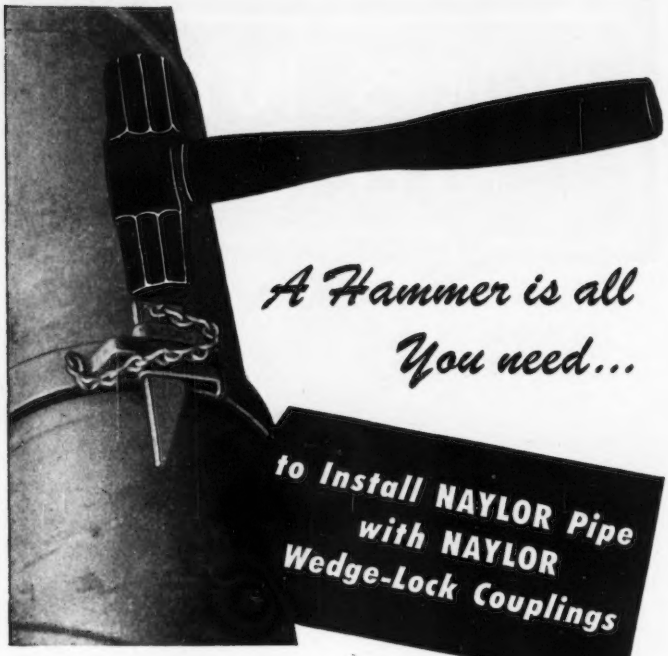


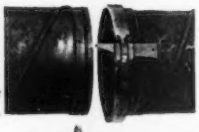
Just 4 Simple Steps Do the Trick

1

Use hammer to drive wedge into the two parallel lugs to open coupling.

2

Slip coupling over pipe end and put next joint of pipe in place.



3

Drive out opening wedge so coupling snaps into place on grooved ends of pipe.

4

Drive wedge home into the three lugs on coupling.

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Company Reports (*Continued*)

acres. Diamond drilling on these lands has established sufficient commercial ore to warrant underground development and surface construction. The project will involve sinking a 950-ft. hoisting shaft, and construction of a 2,000 ton mill. It is hoped that the new mine will be able to operate in the latter part of 1953. **At the Federal mill,** the secondary rolls will be replaced by 5 large rod mills. **At Hayden Creek,** a 2,000-ton sink-float plant will be installed and the property equipped with a head frame and underground crushing plant. To obtain more production 250 large mine cars, 18 shuttle cars, 6 jumbo drilling units, and other mining equipment have been ordered.

At Herculaneum, a new slag furnace for the recovery of zinc and lead has been authorized and should be completed in the early part of 1953. Starting in 1953, Herculaneum will increase the output from about 65,000 tons of lead per year to 100,000 tons. It is hoped that by early 1952, four additional large sintering units can be completed.

Production from the **Balmat-Edwards Division** was 72,548 tons of zinc concentrates in 1950. Plans for increasing the Balmat mill capacity from 1,200 to 1,800 tons per day by 1952 were completed and the construction of work started. The 875-ft. service shaft to supply the new northern orebodies was down 217 ft. and the main underground haulageway on the 900-ft. level was 84% completed. The 7,500-kva. sub-station to handle these increased facilities has been placed in operation. Development at depth in the 400-ton-per-day Edwards mine has been encouraging.

Zinc content of production at the **Josephtown electrothermic smelter** increased from 86,314 tons in 1949 to 97,428 tons in 1950. Increased production from Balmat will reduce the amount of concentrates St. Joe will have to purchase from outside sources, now approximately 57%. A new electric furnace is to be built which should increase output about 10%. A new secondary plant is to be constructed, and an additional turbine installed for utilizing waste heat from roasters.

The Aguilar mine in Argentina milled 174,398 metric tons of ore in 1950, and produced 23,777 metric tons of 77.9% lead concentrates and 24,900 metric tons of 51.0% zinc concentrates. Approximately 10,000 metric tons of Aguilar zinc concentrates have recently been shipped to Josephtown for smelting. The sulphuric acid plant with a capacity of 40,000 metric tons per year, and the **fertilizer plant at Borghi** were placed in operation early in 1951. Construction of the 12,000 metric tons per year electro-thermic zinc smelter at Comodoro Rivadavia has been completed.

CALUMET & HECLA CONSOLIDATED COPPER CO. produced 86,-

963,512 lb. of copper at the Calumet Division in 1950. Seven mines were operated at capacity during 1950. The two tailing reclamation plants produced 6,222,370 lb. of copper during 1950. The zinc-lead mine at Schullsburg at the end of 1950 passed from an exploratory to what is expected to be a profitable operating basis. A large water flow required installation of pumping capacity sufficient to handle 14,400 gpm.

In northern Michigan mechanized equipment was used to remove overburden from bedrock for exploration purposes. This new method is believed to be more effective under conditions present in northern Michigan than the older method of diamond drilling. In the Wisconsin zinc area churn drilling was conducted to extend and outline several orebodies under development and to explore the block of land under lease. Results have been encouraging.

AMERICAN SMELTING & REFINING CO. Production of refineries from products treated on toll for account of others, products of purchased materials, and products of owned, partly owned or leased mines in the last two years:

	1949	1950
Gold, oz.	1,221,367	1,342,431
Silver, oz.	83,887,665	78,270,405
Lead, tons	529,395	578,527
Copper, tons	407,795	474,671
Zinc, tons	153,760	145,920

The new sulphuric acid plant at Garfield, Utah, equally owned by A S & R and Kennecott Copper Corp., was completed in Sept., 1950. Full production will be attained upon the installation of certain auxiliary gas cleaning equipment. It is expected that this will be completed about the middle of 1951.

The new sulphuric acid plant at Tacoma, Wash., began operations in April, 1950, and the new acid unit at Corpus Christi, in May, 1950.

Construction of a new unit to produce zinc fume from lead blast furnace slag at the Chihuahua, Mexico, lead smelter was authorized late in 1950. It is expected that the new unit will be completed by the end of 1952, and will have an annual capacity of 23,000 tons of zinc contained in fume.

Other important construction projects undertaken or completed in 1950 included added power facilities at Corpus Christi, a new waste heat boiler and auxiliary equipment, a new electrical distribution system, and substantial additions to the arsenic plant at Tacoma, Wash., and addition to the sulphuric acid plant at San Luis Potosi, Mexico.

Exploration drilling was continued on the Toquepala copper mine in southern Peru, with favorable results. The drilling program at the Quellaveco copper property, near Toquepala, was completed during 1950. Ore reserves show a substantial tonnage assaying slightly less than 1% copper. The entire tonnage at Quellaveco is susceptible to mining by open-pit method,

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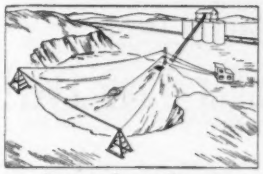
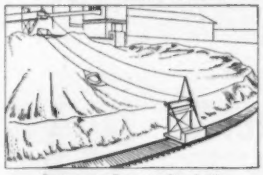
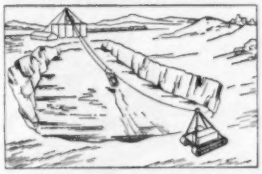


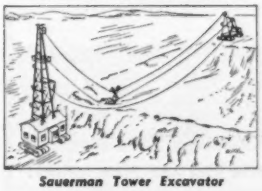
Sauerman Scraper Excavator



Sauerman Scraper Stockpiler



Sauerman Slackline Excavator



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Drag Scraper Excavator—An economical machine for pit and hill excavation, rehandling industrial wastes, cleaning out ponds and general long range earthmoving. It is a powerful excavator and a rapid conveyor.

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Slackline Cableway Excavator — This unique machine has no equal for work that requires digging deep and far and conveying to a high delivery point. In a wet gravel pit, for instance, it reaches under water, comes up with a heaping load of gravel, and lifts its load to the top of the plant, delivering thirty to forty loads an hour.

Tower Excavator—This is a self-propelled drag scraper machine with a high tower at the head end carrying the scraper hoist and a low tower at the tail end. Towers are mounted either on crawlers or on swivel trucks and move along in unison under control of the scraper operator. This machine's long reach and great digging capacity enable it to show especially good results on strip mining, large scale pit excavation, rehandling mine waste and stockpiling.

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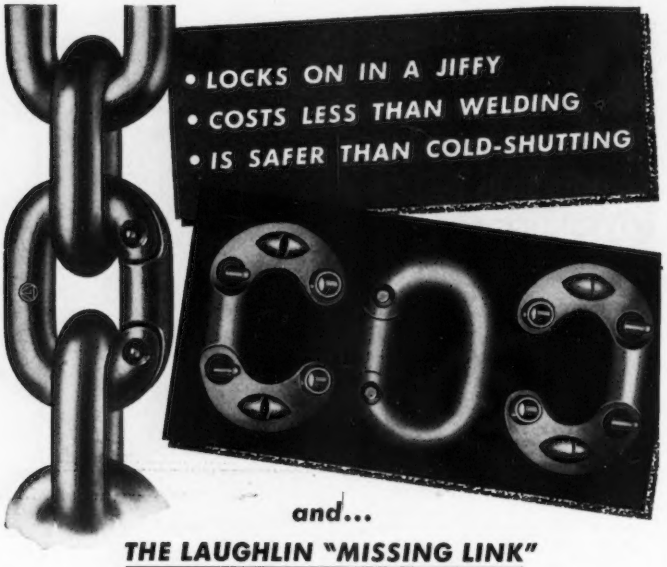

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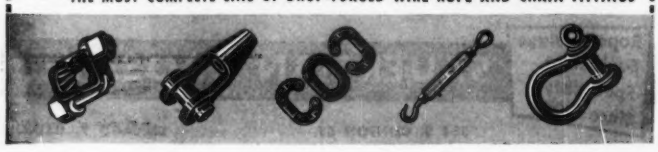

Company Reports (*Continued*)

with a favorable stripping ratio. Consideration of placing either Toquepala or Quellaveco on an operating basis is dependent upon completion of drilling at Toquepala and further investigation of power, water, railroad and port facilities. Engineering studies involved will require considerable time.

Exploration of **Nuestra Señora** lead-zinc property, Sinaloa, Mexico, has indicated a tonnage of ore of profitable grade sufficient to warrant placing the mine on an operating basis. It is expected that installation of mine plant, concentrator and townsite will commence late in 1951.

In Newfoundland, further diamond drilling by **Buchans Mining Co., Ltd.**, which operates the Buchans mine under an agreement with Anglo-Newfoundland Development Co., Ltd., and Terra Nova Properties, Ltd., has indicated new orebodies of profitable grade in addition to those reported in 1949. A new operating shaft, known as the Rothermere shaft, has been sunk to a depth of 1,796 ft., and lateral development is proceeding from the shaft. Sinking of the shaft is continuing to a depth of 2,500 ft. to permit further exploration and mining of ore indicated by diamond drilling at that depth.

NATIONAL LEAD CO. Progress in the field of titanium metal has been substantial. **Titanium Metals Corp.** of America, jointly owned by National Lead Co. and Allegheny Ludlum Steel Corp., has been offering ever-increasing quantities of this metal to the market. Demand, particularly for military adaptations, is substantially in excess of the industry's ability to produce. The company plans, subject to the completion of certain negotiations, the construction and operation of **a titanium metal plant at Henderson, Nevada.**

Company metallurgists have been investigating the **extraction of the cobalt** content of ores mines at its properties in Missouri. Recently there has been developed a new separation process and the company is now exploring the question of production on a plant-size scale.

ANNOUNCEMENT

The U. S. Atomic Energy Commission needs experienced geologists and mining engineers in its Raw Materials Operations. Positions are located in New York City and in Grand Junction, Colorado. Beginning salaries from $4,600 (GS-9) to $8,800 (GS-14), depending on experience. Minimum experience three years. Civil Service status not required. Those interested should write to U. S. Atomic Energy Commission, 70 Columbus Avenue, New York 23, N. Y., Attention Mr. Robert D. Nininger, Raw Materials Operations.

ALABAMA

★An 8x6-ft. Wemco drum-type separator is being substituted for the 10-ft. cone in the heavy-density plant at Shook & Fletcher's Blackburn brown iron ore mine, Russellville, Ala. This plant was described by Alfred M. Shook III in E&MJ, Sept., 1951, pp. 78-81.

ALASKA

★Zinc production in Alaska was 6 tons in 1950, compared with 2 tons in 1949, according to a U. S. Bureau of Mines report. This was chiefly a byproduct from the Riverside mine near Hyder. Lead production in the Territory during 1950 was 150 short tons.

★The Territorial Department of Mines reports that uraninite has been recognized in samples from three areas, Hyder in the southeastern part, Medfra in the Kuskokwin area, and Haycock on Seward Peninsula.

ARIZONA

★Phelps Dodge Copper Corp. is considering development of the large low-grade orebody east of Bisbee, Ariz. (to be named the Lavender Pit), according to a recently issued annual report. Engineering studies and drilling are still under way, and preliminary work such as site clearance is in progress. It is currently estimated that the orebody contains 41 million tons of concentrating ore averaging 1.14% copper; 31 million tons of material to be leached, of an average grade of 0.42%; and 70 million tons of waste which will have to be moved in the future.

The project involves waste removal, the acquisition of electric shovels and drilling and haulage equipment with a projected capacity of 12,000 tons of ore per day. It is estimated that the cost of bringing the mine into production, and installing the plant and equipment to treat the ore will be about $25 million.

Negotiations with the Government to obtain certification of the project as an emergency facility, and a contract for sale of a portion of the production of the project to the Government have been undertaken. No production is expected from this source in any event until 1954 or 1955.

Production figures reported for other Phelps Dodge branches are as follows: Smelter production from the Morenci operations for 1950 totaled 309,353,406 lb. copper. Tonnage mined during the year was 42,829,672 tons of which 16,094,858 were ore and 26,734,814 tons were waste and leach material. Ratio of waste and leach material to ore was 1.66.

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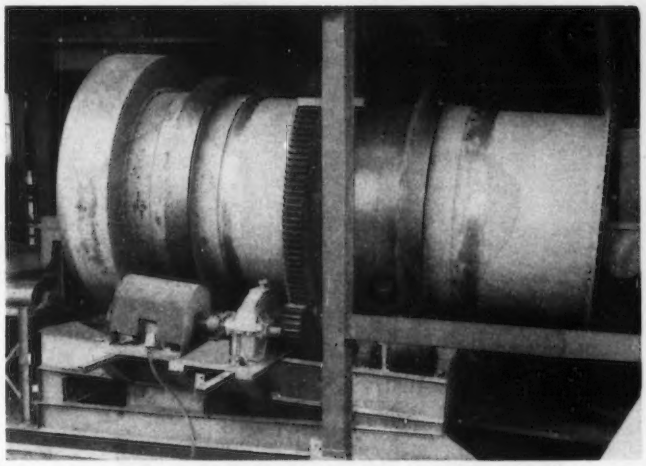

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The Hardinge Counter-Current Heavy-Media Separator is a new separating device now in successful operation on the Mesabi Iron Range. It is a slowly-revolving, inclined, cylindrical drum with spiral flights attached to the inner surface of the cylinder. The material to be separated, accompanied by heavy media, is fed in at the lower end. As the drum rotates, the "sink" is carried by the spiral flights to the high end. The "float" overflows a circular weir at the lower end.

This simple but effective device has no internal moving parts to grind against each other. Thus, maintenance is extremely low. The quantity of media to fill this circuit is considerably less than with a cone of equal capacity. The separator will handle large pieces of ore—up to 4 inches. It can act as a medium reservoir and will start up easily after several hours shut-down.

Data collected during a typical run of a 7' x 16' Heavy-Media Separator (pictured above) on iron ore at less than maximum capacity: Size of feed, minus 4", plus ¼"; specific gravity of medium 3.20; "Sink" produced, 200 tons per hour (dry); "Float," 75 tons per hour (dry); H.P. required, 9.2.

Write for Bulletin 39-B-1.

*The Heavy-Media Separation Processes are licensed by the American Zinc, Lead and Smelting Company. American Cyanamid Company, 30 Rockefeller Plaza, New York 20, N. Y., are their sole technical and sales representatives for these processes.

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Arizona *(Continued)*

★**The Copper Queen Branch at Bisbee** produced 21,203,333 lb. of copper, 11,696,250 lb. lead, and 33,423,374 lb. zince in 1950. Tonnage mined during the year totaled 218,404 tons of copper ore, and 153,730 tons of lead-zinc ore.

★More than $10,000,000 in exploration and development has been spent on the **San Manuel Copper Co.** property near Oracle in central Arizona, according to Wesley Goss, general manager of Magma Copper Corp., parent company.

Development will continue for another year before construction is started on a concentrator and other production facilities, and between $50,000,000 and $75,000,000 will be expended before a pound of copper is produced.

The ore deposit, believed to be the largest in the U. S., contains more than 460,000,000 tons of ore estimated to average about 0.78% copper—a deposit of approximately 7½ to 8 billion lb. of the metal.

The mine ultimately will employ a work force of 1,500.

CALIFORNIA

★Chrome mining has been resumed in Del Norte County, with shipments expected as soon as road and weather conditions permit. **Holiday Mining Co.** is producing chrome at its property on Patricks Creek near Crescent City. An important chromite deposit was uncovered at the Holiday in 1948. Several chromite properties are reportedly active in the French Hill region but the ore can be moved out only during the summer season.

★ **Shamrock Mining Co.**, operating the newly reopened Last Chance property in Nevada County, expects a better than average return from the rich vein discovered last year. Disclosed to a depth of 600 ft. below old workings, the ledge varies in width from 30 in. to 4 ft. It was located by driving a 700-ft. lower tunnel and 400 ft. of drifting. Eleven veins have been found in the mine.

The Ancho-Erie mine, operating nearby, in development of the Erie fissure zone has disclosed richer gold ore than in the Ancho vein which was the principal ore producer. Opened at an approximate vertical depth of 1,200 ft. by a drift from the main Ancho crosscut tunnel, the Erie fissure averages about 20 ft. wide.

★**Best Mines** has almost completed reconditioning the Gold Bluff mine and is considering extensive development of claims covering an area 1,200 ft. wide by 1½ mi. long between Brush Creek and Kate Hardy shafts near Downieville.

★Development of **three bentonite deposits** is reported in San Benito County. One, 30 mi. west of Mendota,

containing an estimated 20 million tons of the mineral, is being developed by E. B. Smith, Dr. Felix Smith, Richard Eachus and John Poggi. The group has purchased three mills, each with a capacity of 100 tons daily, and is installing the first at South Dos Palos for operation by the end of May. The mineral will be mined in an open-pit operation by power shovel and trucked to the mill.

Another deposit, in the Vallecitos Hills region, is being developed by C. Hyde Lewis, for many years general superintendent of the New Idria quicksilver mine. The third, nearby, is being developed by A. D. Lane and associates.

★Kaiser Steel's new screening and magnetic separation plant at Eagle Mountain near the Kaiser Fontana plant is expected to be in operation by the end of April.

The new plant has been designed so that a larger percentage of ore mined will be of a grade suitable for blast furnace operation and to eliminate the stockpiling of mix-grade ores at the mine.

COLORADO

★**Beryllium, Inc.,** under the direction of C. A. Wemlinger, produced a little over 30 tons of high-grade beryl ores durtng the past season from operations below Gold Creek near Gunnison. The U. S. Bureau of Mines diamond drilled this area last spring. These pegmatite dikes are yielding minor quantities of columbite, samarskite, tantalite and other radioactive minerals of the rarer earth series.

★**The operations of the Vanadium Corporation of America** in southwestern Colorado and White Canyon, Utah, are under the direction of D. W. Viles, vice president. The Durango vanadium and uranium processing plant is operating at capacity, receiving ores from distances over 10 mi. The Naturita processing plant is operating at capacity and the acid treating plant located there has been enlarged during 1950. The company's pilot plant is located at White Canyon, Utah, operating on copper-uranium ores. A process has been perfected assuring satisfactory recoveries from the uranium and copper ores, which the company plans to use.

★**King Lease, Inc.,** has extended the inclined raise at the Camp Bird mine to the old Camp Bird fifth level, thereby making another exit from the mine possible. A compressor room was excavated and compressors were installed underground. Tracks in the main crosscut were re-laid with 65-lb. rails replacing the old lighter weight rails; 13,000 ft. of 2-in. 5,000-v. 3-wire marine cable was installed from the surface to the underground compressor room. The property under the management of Minerals Engineering Co., is directed by Norman D. Ebbley in charge of operations. Approximately 75 men were employed.

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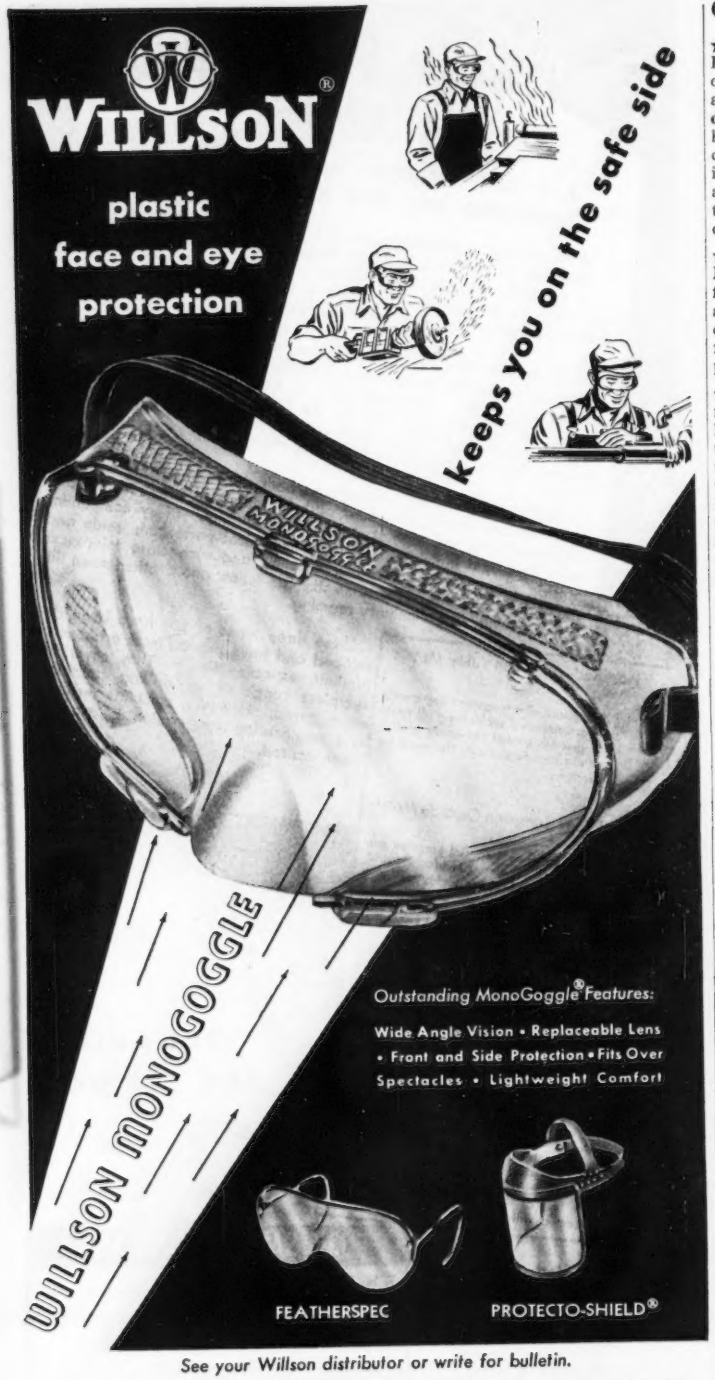

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Colorado *(Continued)*

★During 1950, Front Range Mines, Inc., treated at its mill near Dumont, ore from the rich strike made in 1949 at the **Strong mine in Cripple Creek district.** The ore milled during the year has averaged over $48 per ton in the crude and the concentrates over 30 oz. in gold per ton. Jig concentrates average over 150 oz. gold per ton. One truck load of concentrates netted the company $21,460.

★**Anaconda Lead & Silver Co.**, a Nevada corporation with general offices in Denver, has contracted for the acquisition through purchase, a stock control of Gold Empire, Inc., a Colorado corporation owning a mining property in the Cripple Creek district.

★Gunnison County is in for greater mining operations. The high prices for lead and zinc **permit marginal mines to operate at a profit.** The county treasurer reports that sales are up in the delinquent tax claims department. R. E. Simpson of the Slate River Mining Co. has been buying claims up for tax sale for the past two years, and recently picked up a block of 51 claims in the Treasury Mountain area near Crested Butte. Whether this is solid investment or simply speculation is not yet clear. Many people are in the market for summer home sites, and this undoubtedly explains a good deal of interest. At any rate, tax certificates dating back to the 1880's are in demand.

IDAHO

★The Gold Hunter silver-lead mine at Mullan has been purchased by **Day Mines, Inc.**, for a consideration of 58,425 shares of Day Mines stock to be divided between 17 Hunter mine stockholders. Day Mines stock is listed at $4 per share on the Spokane stock exchange, which would make the cash consideration $233,700.

Independence Lead Mines, adjoining the Hunter on the west, is also involved in the deal in a separate agreement on a lease basis to Day Mines for a period of 30 years with a privilege of renewal for another 30 years on a net production profit basis of 35% to Independence Lead and 65% to Day Mines.

The three properties are on the same vein structure, on which the Morning mine has attained a depth of 5,000 ft. on the west end and the Hunter, 1,200 ft. on the east end, with no deep work in between, a distance of about one mile.

The Hunter is one of the oldest mines in the district, dating back to 1885. Since that time it has been in almost steady operation, either by the company or by leasers. At present it consists of 11 patented mining claims, three patented mill sites and 160 acres of land known as the Hunter ranch. The old upper workings show a vein

structure 300 ft. wide containing lens-shaped orebodies of varying width, which were mined down to the 1,200-ft. level. On this level the company drove a prospect drift easterly and opened a silver-lead deposit on which they sank a winze a distance of 600 ft., all of which was reportedly in ore.

The Day company has been trying to buy the Hunter for several years to serve as an outlet opening for the King group of mining claims, an unbroken chain of patented mining claims extending from Burke to the Snowstorm mine east of Mullan, a distance of about 10 miles. This group is about three miles directly north of the Hunter and the lower Hunter tunnel extends northerly a distance of 5,000 ft. towards the King group, and would give an over-all depth of about 3,000 ft. by extending the Hunter tunnel another 10,000 ft. The present purchase also gives the Day company possession of a 300-ton daily capacity milling plant, residence houses, mine buildings and installed mining and milling equipment.

The Hunter mine itself and the intervening Independence Lead can be opened by drifting on the vein system from the deep levels of the Morning mine. The only obstacle in the way of this deep development was the Fanny Gremm mining claim, and this the Day company purchased several weeks ago for $5,000.

★**Sunshine Mining Co.** reports that it has cut its per-ton mining and milling costs to $15.23 from a previous record of $17.01. Mining costs last year averaged $10.86 per ton, milling 80c., general expenses $3.35 and depreciation 22c., compared to the former cost of mining, $12.10, milling, 90c. general expenses, $3.78, and depreciation, 23c. The company has added four flotation cells in its milling plant to scalp off a high-grade silver-copper concentrate which is suitable for treatment in a copper smelter from tetrahedrite ores that have no appreciable lead content.

★**Silver Dollar Mining Co.** has completed a crosscut from its 1,800-ft. level and encountered a mineralized shear zone of silver-copper ore on the strike of the Yankee Girl vein system between the Sunshine and Silver Summit mines, both of which are producing from the vein on and below the 3,000-ft. level. Where encountered in the Silver Dollar, the vein showed strong mineralization on the footwall side but not commercial grade ore. This streak was followed by drifting westerly for a considerable distance before it developed into an 18-in. wide streak of high-grade silver-copper ore, which has been continuous for over 60 ft. at last accounts.

The company reports a 1950 net profit from a one-third interest in the "Rotbart" area in Sunshine amounting to $879,448. The gross profit was $1,008,368,but 12% of this is paid to Lincoln Mining Co.

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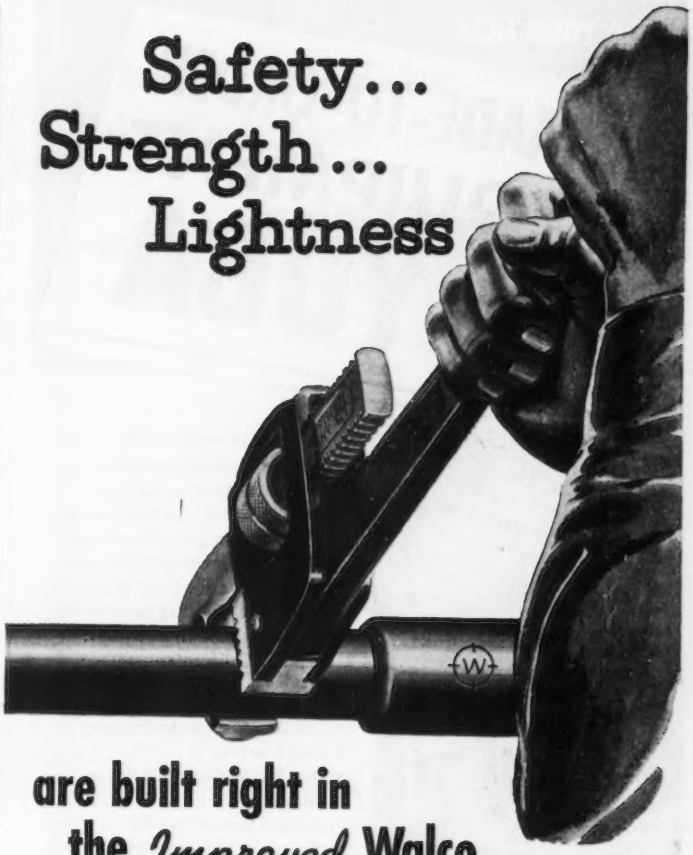

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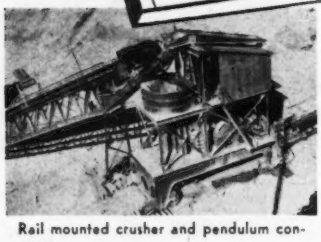

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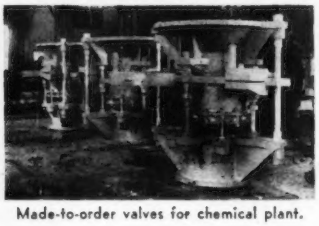

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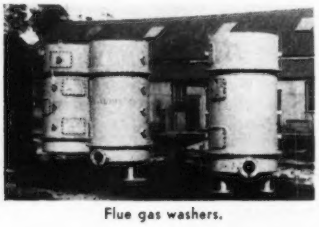

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Idaho *(Continued)*

★**The Hometown Mining Co.** has been organized by property owners in Mullan, Idaho, involving mining rights under land included in the village townsite. The Osburn fault, along the course of which the southern part of the Coeur d'Alene district is located, runs directly through the town.

★Polaris-Silver Summit Mining Co. reports net smelter returns from Silver Summit ore shipments in 1950 at $1,936,479 as compared to $1,227,943 in 1949. Silver Summit is producing from the 3,000, 3,200 and 3,400-ft. levels, and has now decided to raise from the 3,000-ft. level to determine the apex of the vein system and also to drift on the vein system to determine its lateral extent. The company has proven the orebody for a length of over 800 ft. and has developed the ore for 400 ft. below, and 100 ft. above the 3,000-ft. level.

★Sunshine Mining Co.'s annual report for 1950 reveals that the company is producing high-grade silver-copper and silver-lead ores from six different sources, Sunshine, Rambo, Omega, Rotbart, Yankee Girl and Sun-Con vein system areas all of which have a common outlet through the Sunshine shaft. In 1950 Sunshine produced 181,000 tons of ore from the original Sunshine vein, 159,000 tons from the Rambo area, 235,000 tons from the Omega area, 272,000 tons from the Rotbart area 41,000 tons from the Yankee Girl vein, and 14,000 tons from the Sun-Con area. All of these production areas are along four different shear zone vein systems, the Sunshine, Chester, Silver Syndicate and Yankee Girl veins. Six different mining companies, Sunshine, Silver Syndicate, Polaris, Hecla, Silver Dollar and Lincoln share in production profits on different percentage basis agreements.

The company's net earnings for 1950 are listed at $1,660,871 as compared to $794,267 in 1949 and $1,183,645 in 1948. Government geologists are doing exploratory work in the lower levels of Sunshine for uranium ores but so far, the report is that no occurrence of mineable width or grade has been found. Geiger counters, however, indicate uranium in the deep wall rocks of the vein formation.

★**Federal Mining & Smelting Co.** is improving its Page milling plant for fine grinding similar to that employed at the Morning mine plant because of the complex character of its lead and zinc ores. Last year, the company's Page mine produced 154,230 tons of ore averaging 4.03 oz. silver, 6.87% lead and 7.13% zinc per ton.

★**Galena Mining & Milling Co.** plans to develop its Clark group of mining claims on Pine Creek, located between the Douglas mine and the Spokane-Idaho, according to Geoffrey L. Clark.

★**Triumph Mining Co.** in Blaine County, Idaho, has completed con-

struction of a modern 200-ton flotation milling plant following a fire which destroyed the old plant some time ago. During construction of the new plant the company has been shipping crude ore to Salt Lake smelters. The Triumph is owned by the Snyder, Federal and Ivanhoe Mining companies.

IRON COUNTRY

★Employees of nine M. A. Hanna Co. mines will receive safety awards for 1950. The Buckeye, Richmond and Rogers, on the Menominee range, and the Spring Valley, in southern Minnesota, will receive the first award which means no lost-time accidents during the year. The South Agnew and Bengal-Tully will receive the second award for an accident severity rate not exceeding 0.085. The Douglas, Harrison group and Section 18 mines will receive the third award for having had a severity rate not exceeding 0.170. The last five are on the Mesabi.

★Inter-State Iron Co. (Jones & Laughlin Ore Co.) is stripping at its Schley-Pettit mines at Gilbert. Both are former underground mines once operated by Republic Steel Co.

★Oliver Iron Mining Co.'s King open-pit mine at Coleraine is being stripped by the Morrison-Knudsen Co., contractors of Boise, Idaho, who are to remove 2½ million cubic yards. The Oliver will do its own mining when the pit is ready.

★Junior Mining Co., after completing exploratory drilling, plans to strip the Haley mine on and under Longyear Lake at Chisholm on the Mesabi. The property is a State lease and has been known as the Longyear Lake Mining Unit No. 1. A Lima 3½-cu. yd. shovel and five 15-ton Euclid trucks will be used which will be operated for Junior by A. B. Tomasich, contractor, of Virginia, Minn.

★Inland Steel Co. has had 11 diamond drills on exploratory drilling this winter on the "C" orebody at Steep Rock Lake, Ont., which it has under lease.

★As of the last week in February, the Duluth-Superior harbor was covered with ice from 28 to 32 in. thick with a layer of wet snow over it. If colder weather follows the mild spell of late February this soft snow will freeze and add to the ice covering. A year ago the ice was about 20 in. thick. Ice conditions in general are less favorable than those existing at the same date in 1950.

★Contrary to the action of many public organizations in the past, some Chambers of Commerce on the Minnesota ranges have adopted resolutions opposing the proposed increase in the State occupational tax on iron ore which is up for consideration in the State legislature and is recommended by the governor.

★Minneapolis chemical firm has of-

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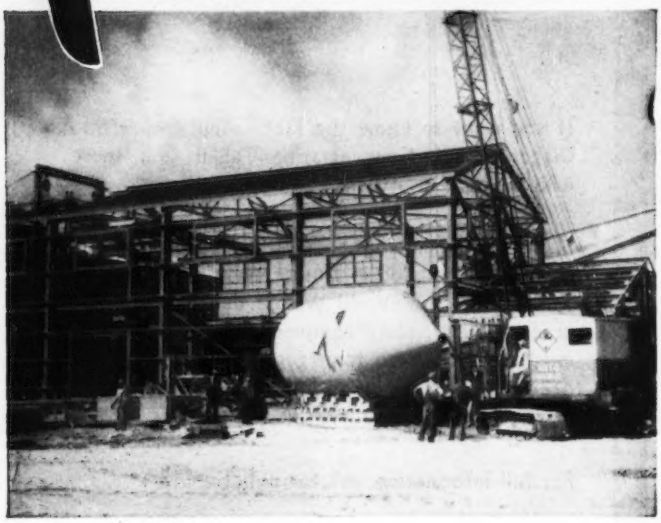

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Iron Country *(Continued)*

fered to buy the **plant for making iron powder from taconite** at Aurora which has been idle for some time. The iron is in carbonate form in the taconite used. Some northern Minnesota members of the State legislature will ask that the Iron Range Resources and Rehabilitation Commission be permitted to dispose of the property. It is understood that the chemical company would use the plant to process Cuyuna range manganese ores.

★At a meeting of the Itasca County Safety Council in Keewatin (on the Mesabi) on Feb. 15, a report on the safety lugs being used on some of its trucks by **Pickands, Mather & Co.** was made by Sid Sicotte, district safety inspector for P. M. & Co. He said that a number of serious accidents had occurred as a result of inflating tires, due to the sudden and unexpected release of the lock rings. The Safety Council group requested the makers of heavy-duty truck rims and lugs to send a representative to investigate the matter so that a standard safety lug could be made which could be used at all mines.

★**The last pump at the Vicar mine** in Wakefield was pulled on Jan. 5. A small gang was still employed to complete dismantling and shipping of equipment.

★A public hearing was scheduled for March 9 and 10 at the county court house in Crystal Falls to discuss a **proposed formula for determining tax assessments of ore beneficiation plants.** This matter is of growing interest as lower grade ores are coming into the mining picture.

★Franklin G. Pardee, deputy state geologist and mine appraiser, has recommended an increase of approximately 15% in **iron mine and mining property valuations** of Iron County, Michigan, for 1951. This will raise total county mining properties valuations from $19,325,000 to $22,360,000. Further increases will result when the Warner mine at Amasa (now being dewatered) and Inland's new Cayia mine reach the production stage. Valuations are low while a mine is in the development period.

★Under provisions of the mining contracts with the CIO union, labor and management will attempt to reach mutual agreement concerning the exact nature of each of some 200 jobs, and job descriptions will be written on the basis of these negotiations. Didace Dion, CIO staff representative on the Menominee and Gogebic ranges, said he expected it would be several months before the necessary training can be completed for this task.

★E. W. Coons and Pacific Isle Mining Co. have ordered a Wemco No. 4 (modified) Mobil-Mill to beneficate iron ores at the **Julia mine,** Virginia, Minn. The new plant, which will use an 8x6-ft. Wemco drum separator, will treat

150 long tons per hour of ore sized at 1½x¼ in.

★ **The prospective demand for iron ore is 15% greater today** than it was a year ago, according to George M. Humphrey, president of M. A. Hanna Co., Cleveland, on March 5, in urging the early completion of the Great Lakes-St. Lawrence Seaway on the Public Works Committee of the House in Washington. Only the ability to use the Seaway will make it possible further to step up the schedule already arranged for bringing iron ore from Labrador and Quebec into this country's central steel-making area.

Speaking of the ore-mining project now on foot in Labrador and Quebec, Mr. Humphrey told that the measured reserves in the concessions of Hanna-Hollinger, Ltd., now stand at over 400 million tons. Financing of the undertaking to the amount of $200-$225 million has been arranged without Government aid, construction of the 365-mi. railroad contracted for, and much construction equipment already moved in. Shipment of 5 million tons in 1955 and 10 million in 1956 or 1957 called for in the Iron Ore Co. of Canada's present already stepped-up schedule. These plans, when made, were based on prospective ore requirements calculated a year ago and could have been carried out without completion of the Seaway. Today the situation is different.

★ Two unusual factors tend to discount the value of steel and iron ore companies' figures from **all-rail shipments of the past winter:** the severe weather which prevailed from the last week in November until mid-February, and the switchmen's strike. According to an unofficial spokesman for U. S. Steel Corp., the past winter's experience was a costly one in the test movement of ore and would have been discarded except for the acute shortage of iron ore at down lake furnaces.

When the program is temporarily halted on March 15, two-thirds of the goal of 2 million tons will have been shipped. Because of the extremely cold weather, 6 to 8 hours was required for thawing a car of frozen ore instead of the maximum 4 to 5 hours. Though the program has proved economically unsound, steel makers may find it necessary to resume all-rail shipping next winter, unless well over 80 million tons of ore are brought down by lake carrier this year.

KENTUCKY-ILLINOIS

★ Installation of a new washing plant at the **Klondike fluorspar mine** in the Kentucky district for the beneficiation of ore in old dumps at the Klondike has been completed by Boyce Moody and William Butler, of Salem. Operation started March 1. Heavy equipment for the plant was obtained from the zinc field in the Joplin region and will handle 30 tons per hour. Ton-

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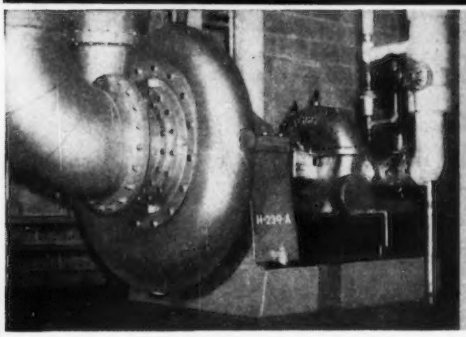

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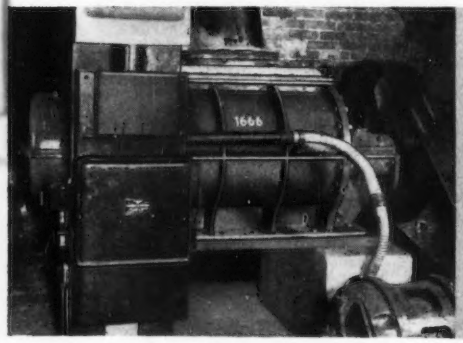

ROTARY

Type RCS Rotary Positive Blower used in smelting operations. Capacity 2,700 cfm.

ROOTS-CONNERSVILLE

BLOWER BUILDERS SINCE 1854

ONE OF THE DRESSER INDUSTRIES

Kentucky-Illinois *(Continued)*

nage washed at the Klondike then will be hauled to the Keystone plant of Inland Steel Co., which was shut down several months ago, and run through the sink-float mill.

★Alcoa Mining Co. has begun shipment of zinc from its Hutson mine, southeast of Salem, Ky. An average of two carloads is being shipped out each week. Capacity of the new flotation mill is 100 tons per day, and the Hutson ore averages 20% zinc.

MICHIGAN

★An increase of $1,597,000 in the assessed valuation of mining properties in the Michigan district has been recommended to the State Tax Commission by Franklin G. Pardee, State Appraiser of Mines. In both Houghton and Keweenaw Counties he commends a total 1951 valuation of $4,132,000, as compared with $3,580,000 last year.

For Houghton County, the appraiser recommends a total valuation of $3,087,000, as against $2,630,000 in 1950. In Keweenaw County the recommendation is $1,045,000, compared with $950,000 a year ago.

The recommended values must be approved and adopted by the State Tax Commission.

All of the recommended valuation in Keweenaw County is for Calumet & Hecla properties, including Ahmeek, Allouez, Douglass, Peninsula, Seneca, and Iroquois. Calumet & Hecla properties in Houghton County are valued at $1,595,000. This includes the Ahmeek mill and railroad, Centennial, Conglomerate and Osceola, North Kearsarge, and Reclamations.

The Copper Range properties are valued at $150,000; Quincy Mine and Reclamation, $520,000; LaSalle, $20,000; Superior, $10,000, and refined copper stocks, $792,000.

MONTANA

★According to Joseph E. Parker, president, the North Butte Mining Co., with large properties on the Butte Hill, expects to be producing copper next June from a new leaching plant now being erected. Mr. Parker states that North Butte has over 3,500,000 tons of leachable copper reserves underground and over 1 million tons in leachable surface dumps. The company recently received a loan from the RFC to do this work and later it expects to receive further financial aid to open promising zinc deposits on its property. Heretofore the corporation has produced very little zinc, but has been a substantial copper producer, especially during World War II. It ceased operations in August, 1947, after the Premium Price Plan had been eliminated. Amount of the RFC loan is $425,000.

★At a recent **manganese conference** held with the Defense Minerals Administration of the Department of the Interior, in Washington, D. C., a number of Montana manganese operators took up their problems with Philip R. Bradley, San Francisco, head of the Manganese division of DMA. Among the Montana operators were L. B. Manning, Sanford Knapp, John Cole, P. Antonioli, W. McW. White, Jr., I. G. Irving and F. A. Linforth.

★According to announcements of Senator James E. Murray (D.-Mont.) and Congressman Mike Mansfield (D-Mont.), a United States subsidiary of **Chromium Mining & Smelting Corp., Ltd., of Canada** expects to build a $2 million chromium smelter and refinery at Glendive, Dawson County, and the same company is carrying on studies with a view of establishing large-scale manganese operations in the Butte district. Leo H. Timmins, Montreal, president of the Canadian company, is reported to have stated that Glendive has been choosen as the site of the chrome smelter because of "low-cost power facilities." Mr. Timmins' company is said to be negotiating to take over the large Benbow chrome mine south of Columbus, Mont., and until chrome ore from that mine is available, it is expected that the new smelter will use chrome ore from the foreign ore stockpile of that company at Spokane. The Benbow mine, operated by Anaconda Copper Mining Co. on a management basis during the last war, produced over 100,000 tons of chrome coincentrates. It is said the Benbow is owned by the U. S. Government.

NEVADA

★**Combined Metals Reduction Co.**, which operates mining properties and a big mill in Lincoln County, is planning to install an electric furnace for treatment of manganese concentrates at the Basic Magnesium, Inc., plant at Henderson. An estimated $250,000 will be spent in addition to $125,000 already spent by the company in developing larger flotation facilities at their mine workings in the Pioche area. If sufficient power can be made available, the company expects to be making manganese alloy by June 1.

★**Nevada-Massachusetts Co.** mine and mill at Tungsten in Pershing County is operating this winter with a force of 200 men and a monthly payroll of more than $65,000. The property is one of the nation's big producers of tungsten.

★Development work on the **Merrimac copper claims** in the Silver Canyon mining district in Elko County has begun, according to George W. Snyder. Mr. Snyder's lease and option on the property was approved recently by stockholders of Union Chief Mining

(*Continued on page 161*)

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SHOWN AT THE ANNUAL MEETING of the AIME, held recently in St. Louis, are Howard I. Young (left), president of American Zinc, Lead & Smelting Co. and chairman of the local convention committee; Donald McLaughlin (center), president, Homestake Mining Co. and retiring president of the AIME, and Willis Peirce (right), New Jersey Zinc Co., Palmerton, Pa., who was installed as president of the Institute.

AIME Meets in St. Louis

CONVENING IN ST. LOUIS for the first time since 1874, the 1951 annual meeting of the American Institute of Mining and Metallurgcal Engineers was generally rated a success. More than 2,500 attended the convention, which lasted from Feb. 18 until Feb. 22, with field trips to Southwest Missouri, the Tri-State District, and to nearby zinc and lead smelters on Feb. 22, and 23.

Willis McGerald Peirce, assistant to general manager, Technical Department, New Jersey Zinc Company, Palmerton, Pa., was inaugurated as the new president, succeeding D. H. McLaughlin. Clyde E. Weed, Anaconda Copper Mining Co., was awarded the Wm. Lawrence Saunders medal for "having brought to the metal industry a new concept of technological and operating efficiency . . ." The Rossiter W. Raymond award went to A. J. Shaler for a paper entitled, "Seminar on the Kinetics of Sintering." Frank R. Milliken received the Robert H. Richards award for contribution to "metallurgy and beneficiation of titanium-bearing ores."

In the Educational Division an outstanding feature was a discussion of the impending shortage of technical graduates and the complications introduced by the draft.

The Mineral Economics Division was concerned with foreign mineral problems, national security, geophysical costs, Tri-State statistics, taxes, tariff, subsidies, mine accounting, and mineral leasing. The Mining Subdivision discussed applications of geology of mining, mine design, drilling and mining methods, and training. Clay and bauxite, ground water, and surface manifestations of orebodies were the principal preoccupation of the Geology Subdivision.

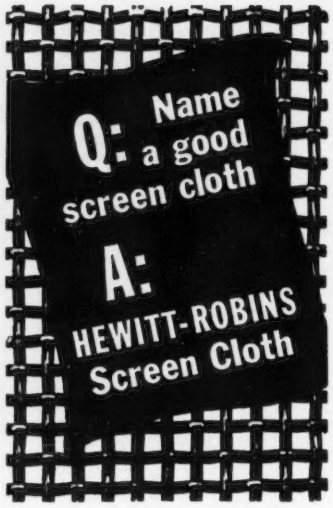
The Geophysics Subdivision discussed geothermy, airborne magnetometry, and resistivity. Canadian industrial minerals, dimension stone, clay technology, pipe-line transportation, and light-weight aggregates were subjects of Industrial Minerals Division consideration.

The Mineral Beneficiation Division had papers on conveyor-belt operation, centrifugal separation, automatic controls, concentration, and new equipment. The Extractive Metallurgy Division discussed lead, zinc, aluminum, magnesium, titanium, copper and cobalt extraction, refractories, and physical chemistry of extractive metallurgy.

Slag Fuming Highlighted

Probably among the most informative sessions of the meeting were Extractive Metallurgy's excellent symposiums on slag fuming and electrolytic zinc. Discussion was lively and the experts "let their hair down" enough to keep attending operators busy taking voluminous notes for two days.

Across the hall, a smaller, but equally intent group waded into physical chemistry. For the most part the papers constituted a first class tour of the outposts of metallurgical technology. It may be well worth while to keep an eye on this group. It's a "good bet" that many of this year's physical chemistry papers will be important topics in operating sessions a few years hence.



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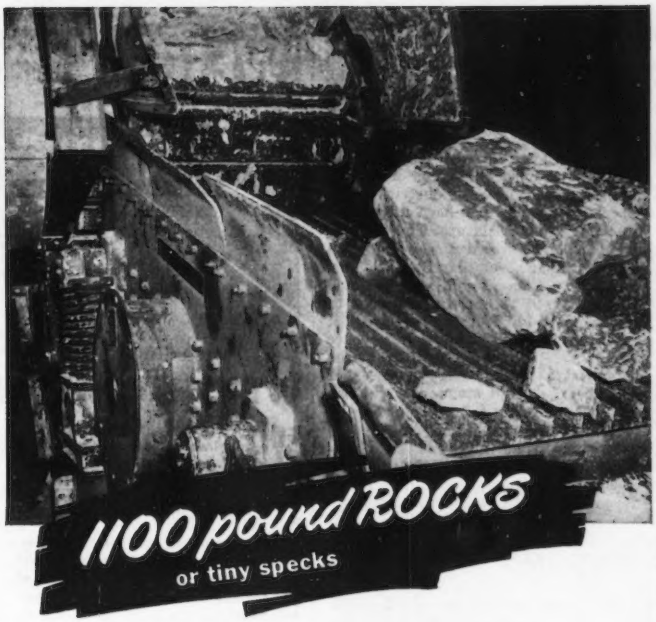

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The big rock you see on its deck is a 3 x 2 x 1½ lump of ore weighing about 1100 pounds. The Scalper handles loads like this at 1000 tons an hour. Yet, it absorbs those loads—and its own vibration—so completely that a coin placed on edge on the base beams will stand up without toppling over *while the machine is running!*

The same company that makes this big brute also makes a small screen called a Ceramic Slip Lawn. This lawn is so precise in action, so effective in operation, that it finds and removes tiny specks of impurities—about ½ pound in every ton of material—from clay slip for pottery plants.

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TRANSMISSION BELTING • VIBRATING CONVEYORS, FEEDERS AND SCREENS

Nevada *(Continued)*

Co., owners of the claims. The contract calls for payment of $250,000 through a 7½% royalty on any production.

★**Sierra Talc & Clay Co.** has 10 men mining and shipping between 400 and 500 tons of good white talc per month from their properties in the Palmetto district near Goldfield. Fred A. Bachich is in charge of the work, and the products are being sent to the grinding plant at Keeler, Calif.

★Forty tons of good grade scheelite tungsten ore is being shipped daily from the **Black Horse mine** in Esmeralda County. Two trucks are used on the haul to the U.S. Vanadium mill near Bishop, Calif. More than 11,000 yd. of overburden have been removed from the face of a 250-ft. hill, exposing the vein which varies from 16 to 30 ft. in height.

★**Artists Gold Mining Co.** has uncovered a vein of shipping grade ore in its property 10 mi. south of Beatty and is planning further development work. Several tons were shipped recently to the McGill smelter of Kennecott Copper Corp.

★**Black Star Development Co.** is milling gold ore steadily at its property in the Trego district of Pershing County, and is reported considering development of its tungsten mine in Black Canyon. Telluride concentrates produced at the Black Star are shipped to a smelter. The ore carries considerable free gold, and the mill is reported making a close recovery of values.

★**AN important strike of high-grade gold ore** has been made in the Jumbo extension mine near Goldfield. The ore has been exposed on the 10th level where a body 5 to 6 ft. wide has been uncovered in a raise. Assay values have run from $488 to $535 per ton, and evidence of depth is reported by the operators.

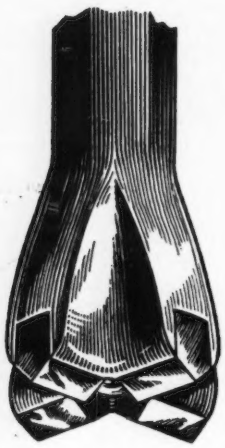
★Gabbs Exploration Co. has started mining operations on its promising **tungsten claims in the Lodi Hills** in Nye County. During the last 18 months the company has done extensive trenching and diamond drilling to determine the extent of the ore. A 100-ton mill has been constructed on the site during recent years.

★**Lindsay Mining Co.** is now open-pit mining the old Gunmetal mine in Mineral County. Tungsten concentrates are being recovered from the company's new 100-ton table concentrator mill situated 6 mi. east of the mine.

NORTH CAROLINA

★**Gold Star Mines, Inc.,** of Gilkey, has obtained a certificate of incorporation from the North Carolina secretary of state to operate a mining,

BLACK'S STEEL Drives Drilling Costs DOWN!



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North Carolina *(Continued)*

smelting and refining business with authorized capital stock of $100,000. Incorporators are Samuel Brooks, A. C. Story and A. S. Workman, all of Forest City.

★A revised **anti-stream pollution bill** designed to meet objections of mining interests and other industries to a previous measure has been introduced in the State Legislature. The original bill did not clearly define or limit the powers of the seven-man State Stream Sanitation Commission, which would be authorized to correct instances of pollution, and industry claimed it should be allowed to know just where it stands. The new bill states that the commission shall develop a series of classifications and standards "for the purpose of classifying each of the waters of the state," and that it shall "recognize that different classifications with different standards frequently may be appropriate for different segments of the same water."

OREGON

★Mining of **alumina-bearing bauxite**, not sale of standing timber, is the primary interest of persons filing 103 mining claims in Josephine County, according to Fred Semler, one of the leading backers of the project. Disclosure of the mass filings recently resulted in charges that the real purpose behind the filings was timber sales. Semler reported that the 50,000 acres involved contain huge quantities of bauxite, assaying from 22 to 52% alumina.

★**Dant & Russell, Inc.**, Dantore division, reports sale of 500,000 3-cu. ft. bags of Dantore in 1950. Dantore is a lightweight plaster produced from perlite ore mined at Lady Frances mine in central Oregon.

★Northwest Electro-Development Laboratory Division of the U. S. Bureau of Mines will build a third plant for the **production of zirconium** at Albany. Estimated cost is $90,000 and the plant should be in production within 90 days, according to Steven Shelton, regional director.

UTAH

★Despite the six-month shutdown early in 1950 caused by low metal prices and labor difficulties, **Park Utah Consolidated Co.** reported a net income of $186,345 without depletion alonwances in 1950. This contrasts sharply with a net loss of $17,503 in 1949 and a slightly larger net loss in 1948, according to Paul H. Hunt, vice president and general manager.

Terming the gain a significant indication of the health of the Park City district, Mr. Hunt recorded these developments in his annual report as

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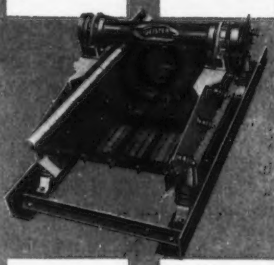

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most important:

Two narrow fissure veins carrying good ore values have been cross-cut on the joint Park Utah-Silver King Coalition ground; work in the Ontario section of the Park Utah property resulted both in the extraction of ore and the location of mineralization on the 1,700-ft. level that "will probably increase in size and grade with depth"; the company is exploring westward in the old Judge unit; deep exploration is under way in the property of the Naildriver Mining Co., a Park Utah affiliate, where Mr. Hunt states "chances seem good for finding a continuation of the silver, lead and zinc ore mined in the early days of Park City on the upper levels."

WASHINGTON

★**Anaconda Copper Mining Co.** made a down payment of $500,000 Feb. 9, when it took over operation of the Bonanza lead mine at Bossburg, and the Bonanza 100-ton mill near Colville, under its option of last November to purchase the property for $2,000,000. E. C. Stephens of the company's Spokane office will be in general charge. He confirmed the report in February that Anaconda was sinking an exploration shaft on the Gold King property near Wenatchee, on which it holds an option which is said to exceed $1 million. Production at the Gold King was second to that of the Holden mine near Chelan in 1950.

★Crater Mining Co. has arranged to purchase the copper holdings of **Morning Star Mining Co.** near Danville, for $125,000, with payments of $1,000 a month the first year, $2,000 a month, the second and $3,000 monthly thereafter. Stockholders of the Morning Star were to meet Mar. 24 to approve the sale. Results of prospecting and bulldozer work this spring will determine future policy. Officers of the Morning company are: Roger O. Oscarson, president; P. Evan Oscarson, vice president, and Kenneth G. Luke, secretary.

★A development program has been planned by **Last Chance Consolidated Mines, Inc.**, at its Last Chance, Great Western and Black Rock zinc-lead properties in the Northport area, according to Roy Magney, a director from Spokane, which will include construction of a 1,200-ft. tramway, and installation of a second ball mill and more milling equipment.

★According to Jess Larson, general service administrator, **Pacific Northwest Alloys, Inc.**, now producing ferro-silicon at the wartime Mead magnesium plant, has been chosen to reconvert part of the plant to magnesium production. It has been estimated that $1½ million would have to be spent for conversion of plant facilities to full-scale magnesium production.

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Bicycle type with renewable special steel liners. Up to 16 ft. dia. with plain or anti-friction bearings.

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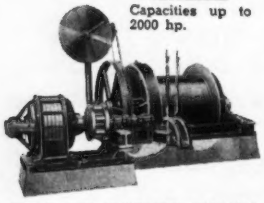
Capacities up to 2000 hp.



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IN CANADA

- **Barvue Plans 4,000-Ton Mill**
- **Gaspe Copper Plans 5,000-Ton Operation**

★Export of Canadian cobalt ores and concentrates will probably be banned this spring, as an aid to building up the Candian stockpile. The price for Northern Ontario cobalt has been raised to stimulate production, with Deloro Smelting and Refining Co. acting as buying agent for the Government. The new schedule ranges from $1.35 per lb. of contained cobalt in ores or concentrates grading 10% to $1.45 for those which run 14% and over. These prices are approximately 50c. per lb. above those formerly scheduled.

QUEBEC

★Barvue Mines, Canada's large new zinc property in the Barraute area has completed designs for a 4,000-ton mill, and production on an open-cut basis is expected to start this year.

Ore potential at Barvue is now calculated at more than 11 million tons from surface drilling along a 1,700-ft. length to an assumed depth of 700 ft. Average of the first 37 holes showed true width of 109.7 ft. with grade of 3.22% zinc and 1.07 oz. silver per ton.

★Bevcourt Gold Mines will be brought into production with its own mill as a result of a deal made with Perron Mines. The latter's 500-ton mill and other buildings will be acquired by Bevcourt for $550,000. On the basis of the bulk milling test made last year it is estimated that Bevcourt has 1,000,000 tons of ore above the 1,000-ft. horizon averaging 0.25 oz. gold per ton.

★Gaspe Copper Mines, Noranda subsidiary near the Gaspe shore of the St. Lawrence River, now has 57 million tons of ore indicated by surface drilling, with grade varying from slightly less than 1% to 2% copper.

Consideration is now being given to development and production, reserves being sufficient to sustain a 5,000-ton operation for 30 years. About $15 million will be required to place the property in production, including cost of mine, mill, power plant, and dock facilities at Mont Louis on the St. Lawrence. Some three years will be required for construction.

★In the meantime Noranda Mines is going ahead with production plans for two other products, iron and sulphur, from the Horne mine at Rouyn. Research on extraction has had favorable results and a $4 million plant will be erected at Hamiltor, Ont. Pyrite

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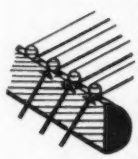

because the smooth, round top and tie rods touch at only one fine point of contact. There are no "pockets" or "blind spots" for even the smallest or most jagged pieces of rock and ore. This means better, faster dewatering, too.

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will be shipped from the mine at the rate of better than 300 tons daily, and the plant will have an output close to 150 tons of sulphur and 100 tons of high grade sinter iron per day.

★Net profits of Quemont Mining Corp. in 1950 were $2.15 per share. In its first full year of production the big Noranda area copper-gold mine treated 759,663 tons, an average of about 2,100 tons daily.

★Normetal Mining Corp.'s estimated net profit for 1950 was $3,040,290. Ore milled totaled 363,297 tons or an average of 945 tons per day.

★Canadian Johns-Manville Co. plans to spend $14 million on a completely new mill for the Jeffrey mine at Asbestos, Quebec. Construction is expected to be completed in five or six years. The Jeffrey mine is the biggest asbestos producer in the world.

ONTARIO

★Aunor Gold Mines reports ore reserves of about 700,000 tons. Grade is 0.36 oz. per ton. This Noranda-controlled Porcupine mine is now starting work at the 2,900-ft. level in the ore probe for which the shaft was deepened in 1949-50 from the mine's present bottom level at 2,125 ft.

★Total output of Silver-Miller Mines in the Cobalt area has passed the 3,000,000-oz. mark. Net earnings are running at a rate of about 40c. per share on the 150,000 oz. of silver being produced each month.

★Falconbridge Nickel Mines is going underground at Levack, 30 miles north of Sudbury. The Levack mine will be No. 3 on the Falconbridge list; the original mine having been well established for years with current milling rate 2,500 tons, while the McKim, its second addition, is being worked up to an output of 500 tons daily. The Levack property was the scene of successful deep surface drilling last year and its shaft, three-compartment, will have an initial objective of 1,200 ft.

★Central Porcupine plans to search for ore at depth. The management is convinced that best ore chances will be found around the 7,000-ft. horizon. Under an agreement with Coniaurum Mines, adjoining Central Porcupine will have its northwest section explored to that depth by a winze from an extension of Coniaurum's 5,000-ft. level.

Coniaurum will do the work, estimated to cost $450,000 and take two years. Cost is to be divided one-third to Central Porcupine and two-thirds to Coniaurum, while the profit from any ore found will be divided in similar ratio.

★Canada's biggest gold mine, Kerr-Addison, increased gold production from $10.3 million in 1949 to $12.2 million in 1950. The mill handled 4,337 tons daily.

FILTERS

Even in the States, ore concentrating mills are distant enough from the factories where milling equipment is manufactured; but what of the mills in South Africa, Philippines, South America, Mexico, Scandinavian Countries? Separating distances can be measured in the thousands of miles.

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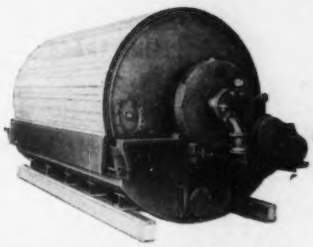
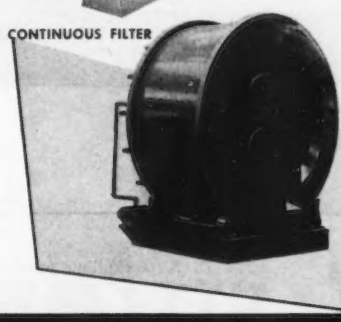


AMERICAN CONTINUOUS FILTER ▼

DORRCO CONTINUOUS FILTER



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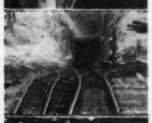

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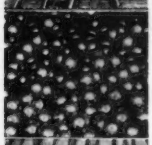

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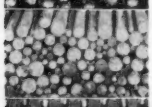

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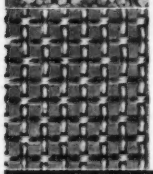

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MANITOBA

★Lee Gordon Mines reports that the geomagnetic survey of its Vamp Lake claims has disclosed one anomaly east of the main island and eight others on the island. The anomalies are to be covered with an electro-magnetic survey. The company regards them as possibly important because of their association with sulphide zones previously intersected.

★San Antonio Gold Mines Ltd. is now milling 550 tons daily. Depth developments are reported to be quite satisfactory.

★The U. S. stockpiling agency has made a formal offer to buy nickel for five years from Sherritt Gordon's Lynn Lake mine. It was announced in Washington that the General Services Administration had sent a letter of commitment to the company.

★Assistance money given to Manitoba gold mines by the Federal Government under the Emergency Gold Mining Assistance Act, is not liable for provincial taxation. This decision was given by the Manitoba Court of Appeal in connection with the Province's appeal against a lower court ruling that San Antonio Gold Mines and Jeep Gold Mines were not liable.

BRITISH COLUMBIA

★Kaslo Base Metals, Ltd., has been incorporated to develop the Index group of 14 claims and two fractions 14.5 mi. from Kaslo and 3 mi. south of the Cork Province mine where a 150-ton mill is under construction. The company has acquired the Index group from Kaslo Silver-Lead Co. More than 2,000 ft. of underground development has been done on the group by former operators. A test shipment from the surface above the upper workings assays 45.5 oz. silver per ton, 37.1% lead and 7.6% zinc. The claims lie in the area of a major mineralized break along which are the Mismark, Gibson, Cork Province, Gold Cure, Silver Bear and Silver Bell mines, all former producers.

★Atlin-Ruffner (B.C.) Ltd. plans to reopen its lead-zinc-silver property in the Atlin district. A syndicate is reported being formed to provide the needed capital. Controlling interest is held by Bobjo Mines Ltd. The property consists of 26 claims on Vaughan Mountain. Plan is to ship available ore and undertake extensive surface stripping by bulldozer to explore two main ore structures. The mine shipped to Trail smelter during the 1920's. Ore in one shaft and drift averages 71.17 oz. silver, plus gold, lead and zinc.

★An exploration program is planned on Crown Silver Lead Mines properties on Nine-Mile Mountain, near Hazelton in Omineca mining division. Financing and development of the property is being undertaken by Transcontinental Resources Ltd. Preliminary sampling indicates an average grade of $75 to $80 per ton in silver, lead and zinc.

★Gross value of Silver Standard Mines, Ltd., production of gold, silver, lead and zinc at its New Hazelton area property during 1950 was $1,739,472. Chiefly responsible for the increased production with a 60-ton mill was the discovery of ore averaging more than $100 per ton in No. 6 vein. Average grade jumped from $61.62 per ton in the first quarter to $104.43 a ton in the final quarter. Operating profit for the year was $795,146. Directors have ordered the immediate sinking of a three-compartment shaft to a depth of 500 ft. below the 1,300-ft. elevation main haulage way.

★Base Metals Mining Corp. will spend $150,000 to improve efficiency at its Kicking Horse mine at Field, and to reopen the former West Monarch mine, which forms part of the main property and has been idle for many years. About $125,000 will be spent on the Kicking Horse, mainly in driving a new 2,400-ft. exploration and development adit which will then become the mine's main haulage system. Workings of the West and East Monarch mines will be connected by drifting and raising, and ore will be trammed through the East Monarch.

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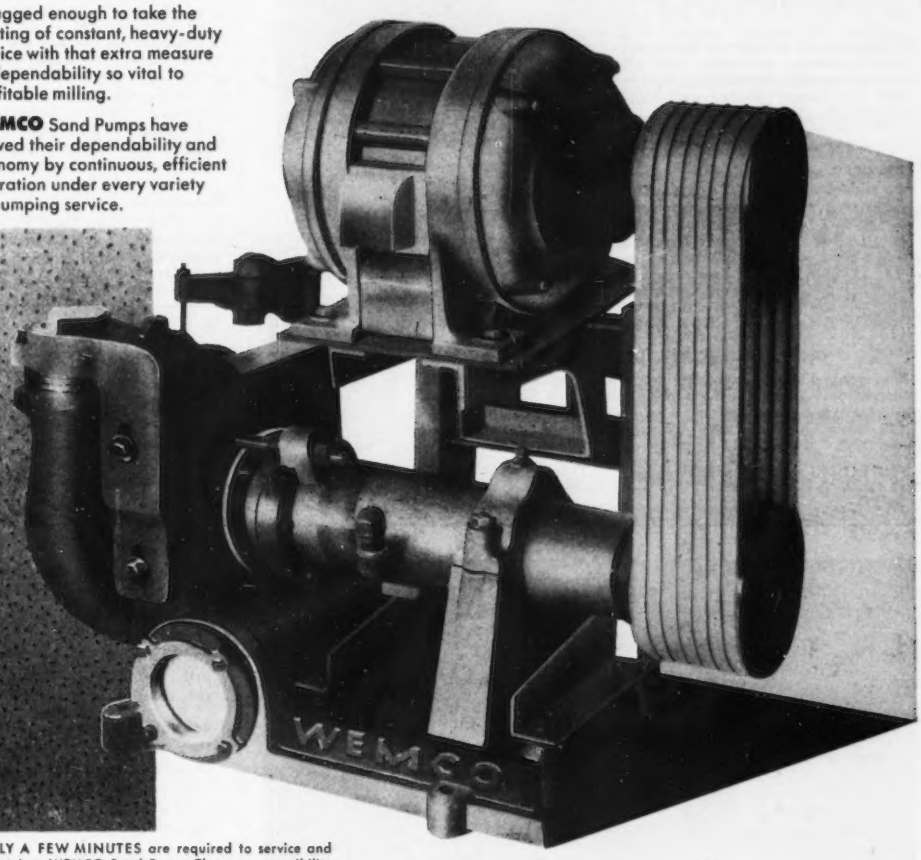

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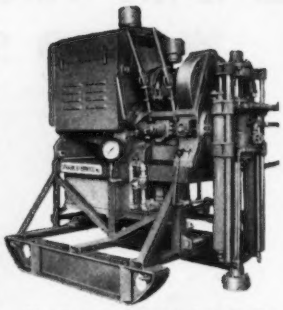

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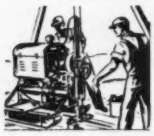

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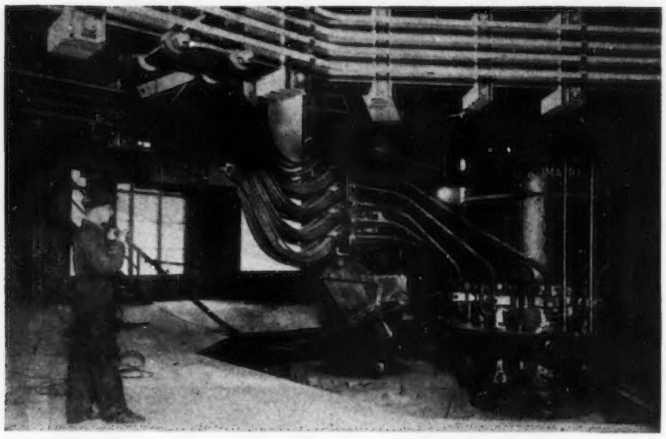

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Canada *(Continued)*

★Glacier Gulch Mining Co., Ltd., which recently secured $33,000 worth of new equipment, including a new 500-cu. ft. compressor, has commenced underground development at its gold-silver-lead-zinc property near Smithers. Work started early in February with the driving of a raise from the new low-level at 2,600-ft. elevation.

★Lode-gold production value B.C. rose to an estimated $10,600,000 in 1950 compared with $10,382,256 in 1949. Bralorne Mines Ltd., Bridge River, produced 77,239 oz. valued at $2,703,356; Nickel Plate mine of Kelowna Exploration Co., Ltd., 47,800 oz. from 126,429 tons; Polaris-Taku Mining Co., Ltd., 35,904 oz. from 95,667 tons; Pioneer Gold Mines Ltd. 35,300 oz. from 74,700 tons; Cariboo Gold Quartz, 24,048 oz.; and Island Mountain Mines, 16,807 oz.

YOU'RE FIRED

ROLE-PLAYING, as a technique for training supervisors, has been highly successful at Hollinger. An important factor in this success has been the enthusiasm of the supervisors participating. Just how the men can get carried away is illustrated by an incident at one of the early sessions.

Supervisor X was assigned the role of a mine captain who had a union steward in his crew. The steward had stopped doing any work and the supervisor had to talk it over with him to correct this condition.

Another supervisor was assigned the role of the union steward. His stand was to be that he, as steward, was responsible for several hundred men, a lot more than the captain was responsible for.

Steward and mine captain talked things over, but the steward's recalcitrance began to get under the skin of the supervisor until he could take no more. Completely carried away, he stood up, banged a meaty fist on the desk, and in a voice filled with passion, roared, "You're fired, you —— — — ——."

(See complete story on pg. 90)

YUKON

★United Keno Hill Mines' net profits for 1950 will reach $1 or more per share, it is reported from Whitemore. This compares with 14.9c. per share in 1949 and 24.6c. in 1948. Gross value

is said to be about $6 million, silver contributing $2.5 million of that total. Lead, zinc and cadmium make up the rest. Tonnage in 1950 averaged about 225 tons daily, but the mill installed last fall shoud raise that average to 350 tons per day.

★The Giant mine of **Hedley Mascot Gold Mines,** 40 mi. south of Golden, expects to be in operation this spring. A reconstructed 200-ton capacity mill was nearing completion in February. When this mine is in production, it is said that the Hedley company will turn the Giant over to a new company, partly owned by the Hedley, known as Giant Mascot Mines, Ltd.

★Dredges of **Yukon Consolidated Gold Corp., Ltd.,** which operated until Nov. 6, 1950, took an estimated $2,540,000 worth of gold from river gravels during 1950. A record of $2,834,631 was established in 1942. In 19 years the company has taken out $30,767,000.

IN EUROPE

AUSTRIA

★**New lead-zinc deposits** discovered recently in Upper Carinthia appear so promising that Bleiberger Bergwerks-Union has decided to begin development work on the orebodies. The Company (BBU) is already mining the largest lead-zinc orebody in Carinthia. Samples from the new deposits show lead 2.5%, zinc, 3.1%, pyrite, 3.3%, and iron, 3.2%. Concentrates carry 64% lead and 33% zinc respectively. Though not high, these assays are enough to arouse interest in European mining circles.

★**Austria's mine output** of iron ore reached 1,859,400 tons last year, which is just under the pre-war peak of 1,884,900 tons. During the war, output rose briefly to over 1,900,000 tons. The increase for 1950 (25% over 1949) was achieved largely through ECA aid, which made possible the purchase of new mining machinery. Nearly all of Austria's output comes from the Styrian workings belonging to the Alpine-Montane company. The major part of this iron ore goes to the steel works at Donawitz and Linz. Austria uses more iron ore than she produces, however. Imports last year came to 197.800 tons.

★The ECA office in Vienna announced recently that a mill for **processing antimony ore** began operating in Carinthia in Mid-November, 1950. Construction of the mill was financed by ECA. Annual capacity is 7,200 tons of crude ore, which yields 340 tons of antimony concentrate, or 160 tons of pure metal a year. Austria's domestic consumption of antimony comes to about 120 tons per year.

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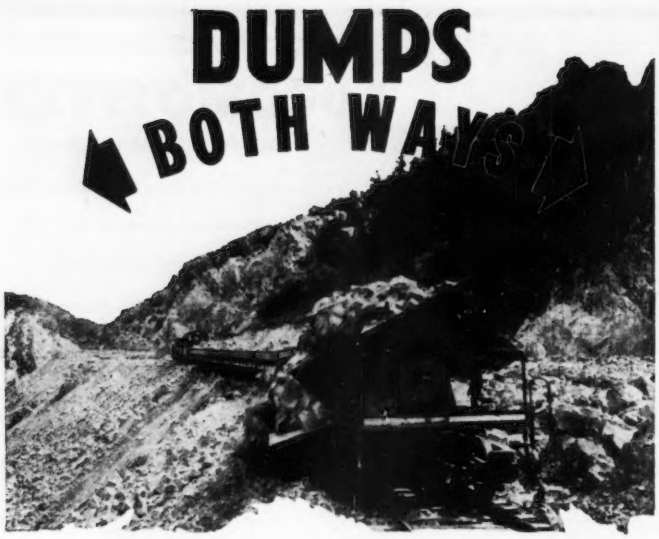

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IN THE PHILIPPINES

★**According to an official estimate** by the Philippine Chamber of Mines, gross value of the mineral production of the Islands in 1950 exceeded pesos 81,370,000, or $40,600,000 at the official exchange rate. Gold accounted for 41% of the gross production with an output of 333,991 oz., valued at pesos 33,400,000. This would indicate an average price of about 100 pesos ($50) an oz. was realized. As 75% of the bullion output of the mines could be sold on the open market at more than the statutory price, it is obvious that sales on the open market brought in substantially more than $50 an oz.

★**Copper output in 1950** totaled 10,384 metric tons valued at pesos 8,254,000, a large increase over 1949. The increase is due to Lepanto, which doubled its milling rate to 1,000 tons daily last June.

★**Iron ore exports** to Japan increased sharply in 1950, reaching a total of 599,095 tons, grossing over pesos 7,633,000, or about pesos 12.50 per ton.

★**Benguet - Balatoc's mill** produced $570,000 in gold in January, at the $35 price. Milling rate was unchanged at 2,400 tons per day. Average value recovered per ton was $7.90, slightly higher than in December. Production at **Atok-Big Wedge** was unchanged at $167,000 from milling 14,260 tons.

★**Lepanto's January output** was valued at $600,900 from milling 30,035 tons of copper-gold ore during the month. This mine is the Philippines' largest dollar-producer today. Production in January consisted of 4,348 tons of concentrates averaging 28.1% copper and 0.721 oz. gold. Ore milled averaged 4.27% copper and 0.126 oz. gold. Of the gold recovered from the concentrates in Tacoma, 25% is deposited with the Federal Reserve Bank in San Francisco to the credit of the Philippine Central Bank, which pays Lepanto at the statutory price. The other 75% is flown back to Manila for sale on the open market. The export license for the concentrates specifies, however, that all dollar proceeds must be brought back to the Philippines. The company thus suffers from inability to use its own dollars to buy equipment and supplies in the U. S. It has to buy back the dollars in Manila, with consequent loss of time and income.

IN LATIN AMERICA

BRAZIL

★**Scheelite miners** in northern Brazil are getting excited by the surge in the market for tungsten ores. Prices as high as Crs. 80 (about $4.00) per kilo have been reported, as compared with a price of Crs. 33 which prevailed during World War II. In the hope that ore may be the subject of barter arrangements with the U. S., there is talk of the price reaching Crs. 100.

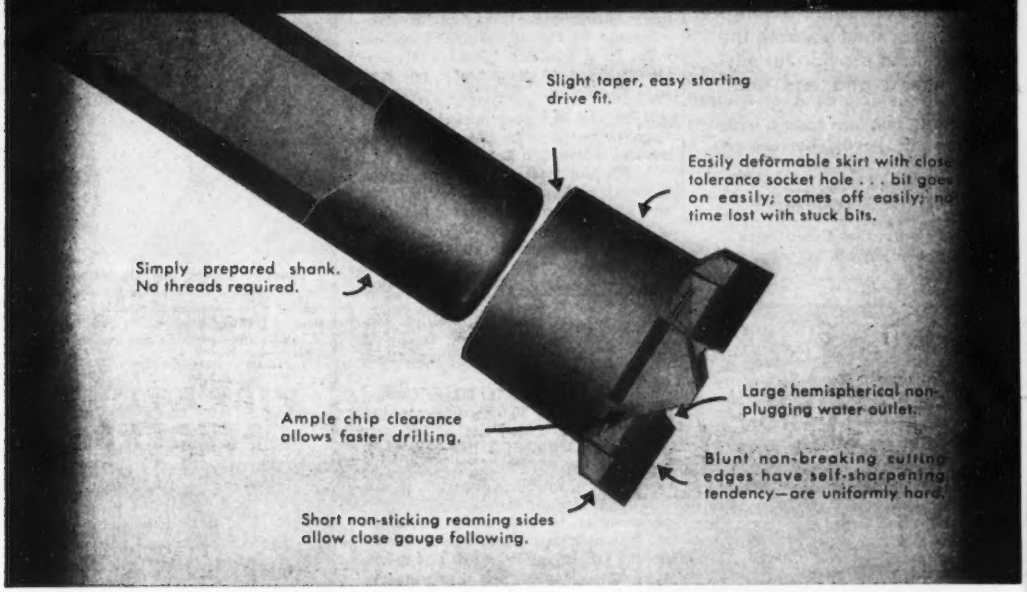
★**The border country** between Bolivia and Brazil seems headed for a program of mineral development under the new Vargas administration, with manganese and petroleum as the goals. Although nothing definite has been announced, the following picture is developing:

1. Vargas intends to push ahead with the coast-to-coast railway that will eventually connect Sao Paulo, Brazil, with Arica, Chile. He aims to put a line through to Santa Cruz de la Sierra, Bolivia, within a year. Its present terminus is south of Corumba, Brazil, on the Rio Paraguay.

2. Vargas intends to take up with Bolivia the terms of a pre-war treaty

THROWAWAY

DETACHABLE ROCK BITS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The Throwaway Standard 1" Socket Steel Bit

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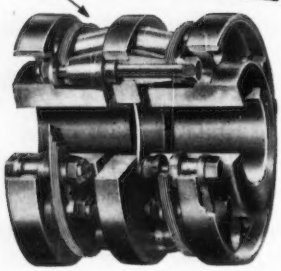

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WARREN, PENNSYLVANIA

Latin America *(Continued)*

that would allow Brazil oil exploration rights in the Tin-Tin and Cochabamba areas of Bolivia.

3. On the assumption that oil would be found, talks are going ahead looking toward founding an oil refinery at Corumba on a small scale.

4. Brazil has given exploration rights to U. S. Steel covering a manganese prospect near Urucum, not far south of Corumba. Legislation is before the Brazilian congress to grant tax exemptions, import licenses, and import duty exemptions to the company handling the prospect. The remoteness of the deposits, 800 airline miles from Sao Paulo, makes it problematical as to what may be done with them.

★**Here are the four nickel deposits** thus far found to be of possible commercial interest in Brazil:

1. At Niquelandia, state of Goiaz, there is a deposit of around 25,000 metric tons running about 6% nickel in the form of garnierite, the silicate.

2. Near Liberdade, Minas Gerais, there is said to be a deposit of several hundred thousand metric tons running around 2% nickel.

3. Near Santa Cruz, in Minas Gerais, there is reported to be about 500,000 metric tons running about 1.5% nickel.

4. Near Santa Maria, Minas Gerais, there is another 30,000 tons running slightly better than 2%.

Of these, only No. 1 has been seriously considered thus far. It was taken up by American Smelting & Refining Co. some years ago, but later dropped. It is now being examined by **Falconbridge Nickel Co.** whose agents are trying to work out terms for a concession to the Goiaz property with the purpose of testing the company's nickel recovery process on the ore. The chief difficulty with the property is probably its location, which is 400 km. beyond the most distant railhead.

COLOMBIA

★**Gold and silver output** in Colombia in 1950 reached 12,637,962.87 grams of gold (406,319.63 oz.) and 3,611,239.75 grams of silver (116,103.96 oz.). This is an increase of 21,012.92 oz. of gold and 9,426.01 oz. of silver over 1949. This production is valued at $14,058,538.86 net, of which $9,782,486.18 was produced by companies operated with foreign capital.

★**Industrias de Purace** is mining sulphur deposits on the slopes of the Purace volcano near Popayan. The company recently mechanized its methods and is now capable of producing 1,000 tons of sulphur a month. For the first time in Colombia's history, a shipment of sulphur, 500 tons, was shipped by the Purace company in January to the United States.

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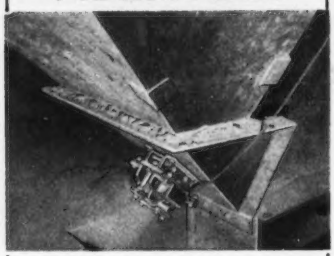

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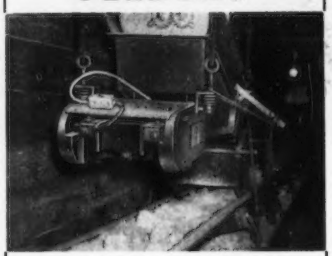

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MEXICO

★Mexico is planning **export control of sulphur** according to the Ministry of National Economy. No exports will be permitted until Mexico's needs, about 11,500 metric tons per year, are taken care of. Thereafter, any excess sulphur will go to those countries where sulphur is used to prepare materials for Mexican industry. Cuba, for example, produces rayon for Mexico's tire and textile industries, and would presumably get any surplus Mexican sulphur. Mexico's biggest sulphur mines are in San Luis Potosi state, which produces about 1,000 tons per month.

★**Production of non-ferrous metals** in Mexico in 1950 ran well ahead of 1949. Copper production rose from 57,240 metric tons in 1949 to 63,576 tons in 1950. Lead output was up from 220,848 metric tons to 241,920 metric tons for 1950. Zinc climbed from 178,404 metric tons in 1949 to 229,860 metric tons in 1950. Gold was up from 405,564 oz. in 1949 to an estimated 417,024 oz. for 1950. Silver was steady at about 49,000,000 for the year, about half of what silver production came to a decade ago.

PERU

★**The first positive action** to be taken under Peru's 1950 Mining Code got under way recently with announcement of plans for building a 200-ton daily capacity electrolytic zinc refinery for **Cerro de Pasco Copper Corporation.** The Export-Import Bank made public on February 1 the details of the loan on which the new construction is based. Cerro receives $20,800,000 at 4½% interest. Amortization is to be in 20 semi-annual payments beginning in 1956. The loan rests on a security contract between Cerro and the Peruvian Government, whereby exchange facilities for dollar purchases and payments are guaranteed. The contract, in turn, rests on the 1950 Mining Code, which is the most liberal in existence in any South American country.

★In Lima, on February 3, **Robert P. Koenig,** president of Cerro de Pasco, in commenting on the significance of the zinc refinery, told an **Engineering & Mining Journal** correspondent, "We are providing more employment in Peru, and the country's economy will benefit. When we refine, in Peru, the zinc concentrates that are now going abroad, we will make it possible to handle lower grade ores. There will be a corresponding relief on U. S. labor and transportation facilities. Otherwise, the world zinc picture will be unchanged."

★Mr. Koenig gave these details on the new project: **The first unit,** turning out 35 tons per day, will be ready in August, 1951; the second 35-ton

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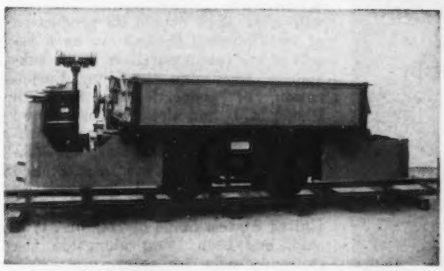

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Latin America *(Continued)*

unit should be running late in 1952; the third unit, at 130 tons per day, should be ready in 1954 or 1955. Cerro will spend about $9,000,000 in Peru, the remainder of the capital expenditure being reserved for equipment purchases in the United States. A hydro electric plant in the Paucartambo Valley, the first one on the Eastern Slope, and a 40-mile mountain highway must be built.

★Mr. Koenig also pointed out **Cerro's increasing activity in lead and zinc** production. Lead output in 1950 was 70,000,000 lb., 20,000,000 lb. greater than the company's copper production. From now on, Mr. Koenig said, zinc would get the major part of the company's attention in the Cerro de Pasco region. Copper will continue to be mined for many years, actually seven years, if known reserves of copper are assumed to be total reserves. Known reserves of lead and zinc ore total more than 10,000,000 tons, which will provide a longer mining activity than the copper.

★Confident of **many good years ahead** for the Peruvian mining industry, Mr. Koenig gave full credit for vision and initiative to Peru's President, Sr. Manuel A. Odria. The sincerity and the intelligent action of Sr. Odria and his technical assistants are exemplified both in the Cerro contract and the Peruvian Mining Code under which it was written.

IN AFRICA

★The rapidly increasing zinc content of the Kipushi ores at depth has caused the formation of **a Union Miniere subsidiary** to build and operate a new zinc plant in the Belgian Congo with an annual capacity of 36,000 tons of zinc. Production is not expected, however, before 1954.

★**Vanadium Corporation of America** will more than double its production of metallurgical chrome ore as a result of the recent purchase by its subsidiary, Rhodesian Vanadium Corporation, of properties in Southern Rhodesia. It had already been pointed out, however, by various chrome producers in Rhodesia that around **500,000 tons of chrome ore** is stockpiled idly for lack of rail transport to Beira, the port of shipment to the United States. Some of this ore, it is said, has been lying alongside the railroad tracks for years.

★**The Krupp-Renn process** for treating low-grade and titaniferous iron ores will be used in a pig iron plant to be built by the Krupp Works of Essen, Germany, in the Eastern Transvaal. The process is said to be able to handle ores too low grade to be treated by ordinary blast furnaces.

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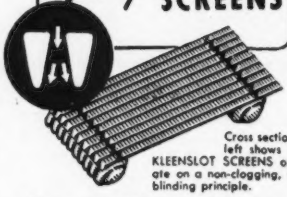

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In a recent letter Mr. Chessher said: *"The Catalog is the best we have seen."* If PRE-FILED MINING CATALOGS is not available for buying reference at your mine write to McGRAW-HILL CATALOG SERVICE, 330 West 42nd Street, New York 18, N.Y. There is no charge to qualified users.

★**The International Monetary Fund** announced recently that a means would be sought to restrict the Union of South Africa's practice of selling about 40% of its gold output on the free markets of the world at a premium price. This has been done on the plea that the gold was going into use in "the arts and in industry." Actually, most of this gold went into private hoards in Europe and elsewhere. The Fund, feeling that this practice tends to weaken faith in the world's currencies, wants to stop it. South Africa, according to N. C. Havenga, finance minister, is determined to continue the practice. Mr. Havenga claims that his fight to get an official increase in the price of gold is gaining strength.

IN AUSTRALIA

MELBOURNE

★In an endeavor **to divert more capital** to industries of national importance, the Australian government has reimposed controls over corporate capital issues and over individual bank loans. The National Security Resources Board has drawn up a schedule of priorities which will serve as a guide in the allocation of investors' capital and of bank money. Coal and metal mining industries rank high in this schedule.

★**Production of gold** in Australia for the eleven months ended November 30, 1950, was 787,206 oz., a decrease of 29,054 oz. or about 3½ per cent from the corresponding period of 1949. In November the output was 80,528 oz. against 81,506 oz. for November, 1949.

WESTERN AUSTRALIA

★In a report written for the prospectus of **Kalgoorlie Southern Gold Mines N. L.** two well-known mining experts, G. L. Clark and F. F. Espie, recall that since the early days of prospecting in Western Australia by Western Mining Corporation, Ltd., and its associates the possible extension of the Kalgoorlie field was seen as a prize of the first order. The most important result of the extended survey of the area that has taken place is the indication of a possibility of a repetition of the Kalgoorlie field to the south. To secure the area of interest, Kalgoorlie Southern has acquired 2888 acres of leases from Gold Mines of Kalgoorlie, Ltd. The leased area is now being adjusted in accordance with latest geological information. One significant factor in assessing prospects of any important extension of the Kalgoorlie field is whether secondary enrichment plays a dominant part in raising the grade of the ore, the report says. It is probable that there was secondary enrichment of the very rich ore worked in the early days of the field. On the other hand, from the continued production of high-grade ore for so many years, much of it from depths below any possible secondary enrichment, the authors conclude that secondary enrichment of grade is not a major factor.

The depth at which ore might be expected to the south is quite unknown, but effective testing for vertical lodes by drilling from the surface may become difficult at depths below 3,000 ft., the report says. However, there would be no difficulty in mining to at least 5,000 ft. as no unusual provision for ventilation or for coping with rock pressures is necessary in the Kalgoorlie field at depths approaching 4,000 ft. today. Preliminary estimates indicate that the cost of opening mines to 5,000 ft. would not be excessive if tonnages and grade approaching the order of Kalgoorlie production are found, the report concludes. The company is prepared to spend $225,000 to $337,000 on initial tests.

★Treatment of a further 2,800,000 tons of sands at Trafalgar is to be undertaken by **Lake View & Star, Ltd.** In applying for renewal of its treatment license, the company expressed confidence in its ability to treat the dump profitably at today's Australian gold price. As it would take three years to install a new plant at Trafalgar, the company has decided to pump the sands to its present treatment plant over a distance of 80,000 ft.

TASMANIA

★Long-term contracts concluded by the U.S. and U.K. governments with **King Island Scheelite (1947) Ltd.** have highlighted Australia as a supplier of tungsten minerals. Compared with such big-time producers as China, Burma and Korea, Australia, according to E&MJ's correspondent, has been a mere piker, and still is. Australia's position in the free world's mineral strategy is based largely on the elimination of her tungsten-producing competitors by war and unrest.

Important deposits of tungsten ores occur in Queensland, New South Wales, Tasmania, and the Northern Territory. Queensland holds the cumulative production record though recent production has been relatively small. In recent years most of the Australian output has come from Tasmania, with the Northern Territory accounting for much of the balance.

Tasmania has probably also the greatest potentialities for increased production. The output comes almost entirely from well-established mines. On the main island, the principal producing mines are Storey's Creek

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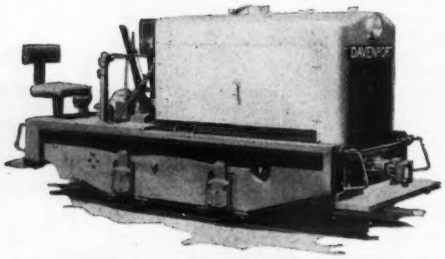

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Australia *(Continued)*

Tin Mining Co. N.L. and **Aberfoyle Tin N.L.** Both mines are recovering tin concentrates in addition to wolfram.

King Island Scheelite operates on King Island, about halfway between Tasmania and the Australian mainland. Its leases cover the most important individual source of tungsten ore in Australia. The amount of ore indicated up to 1943 was approximately 2,000,000 tons with an average grade of 0.64% WO_3. This estimate was later revised to about 3,000,000 tons of unspecified grade. The proposed sale of operations on reorganization of the company in 1947 was 5,000 tons of ore per week. On the basis of 0.6% ore and a recovery of 72%, the mine should be able to produce 1,800 tons annually in terms of 65% WO_3 as soon as the throughput target is realized. Though the recovery rate has been improved over the original estimates, considerable further plant expenditure will be necessary to lift annual production above 1,000 tons. In the last reported four-weekly period King Island treated 13,606 tons of crude ore for 48.78 tons of scheelite concentrates. In the previous three working weeks, output of scheelite concentrates was 49.39 tons.

★The blast furnace of **Mt. Lyell Mining and Railway Co. Ltd.** operated only 56 days in the quarter ended December 31 and further cutbacks are likely as coal production is running 20% below normal due to weekly work stoppages in the principal Australian coal mines. Compared with the July-September quarter, blister copper production fell by 20% to 1,616 tons. Installation of a new ball mill and classifier has been completed. The company has purchased nine 20-ton trucks for the open-cut operation. The first several 5-cu. yd. shovels will be in service within the next few weeks.

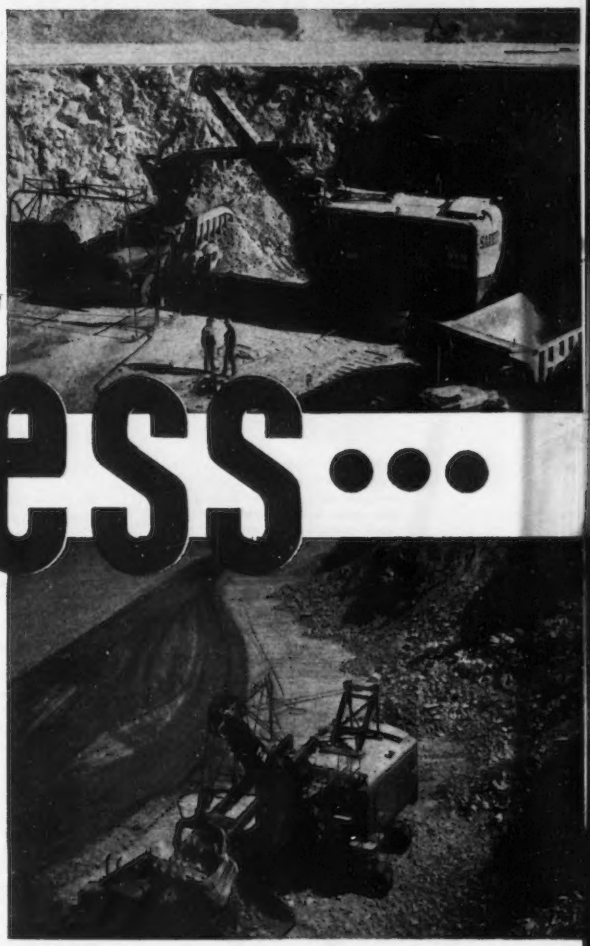
NEW GUINEA

★Reconstruction of **New Guinea Goldfield's Golden Ridges mill** is half completed. Work done includes installation of a main ore bin and a stamp battery.

★**Bulolo Gold Dredging** produced 17,010 oz. of gold in the three months ended November 30. In the corresponding period of 1949 the company's output was 19,040 oz. although values per cubic yard were lower.

★**Raub Australian Gold Mining Co. Ltd.** passed the break-even point in the year ended March 31, 1950, with a small profit of £38. In the previous year it ran up a loss of £14,369. Gold production was increased considerably, though the mine did not reach full production. Further shafts were dewatered and made ready for use in the future.

you can't beat progress...



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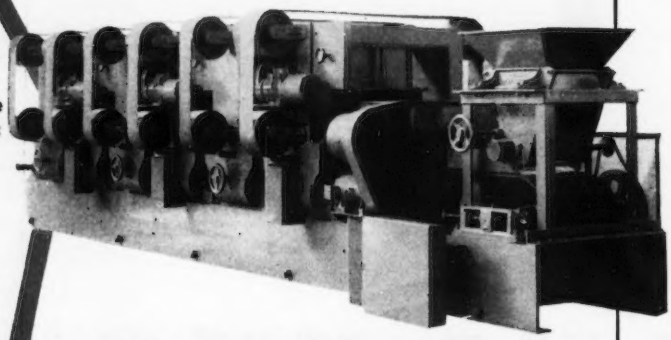

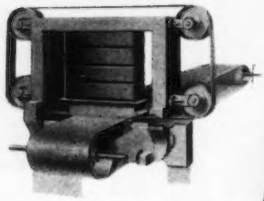

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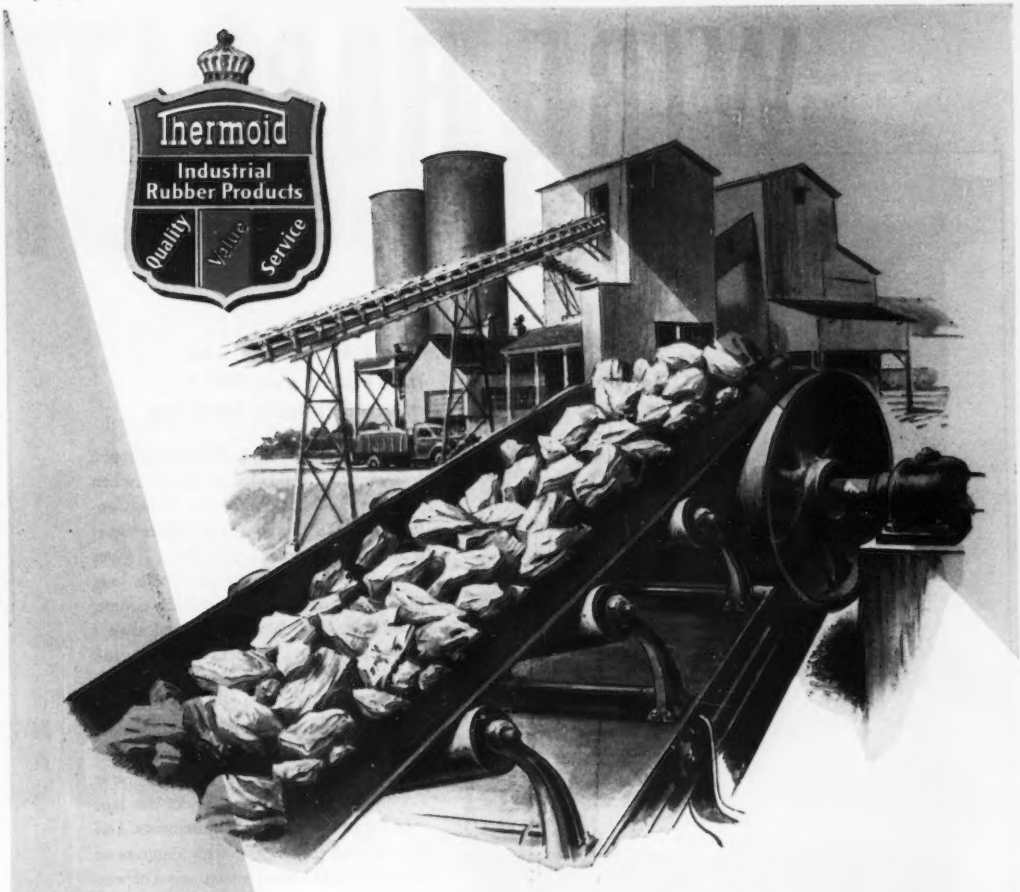

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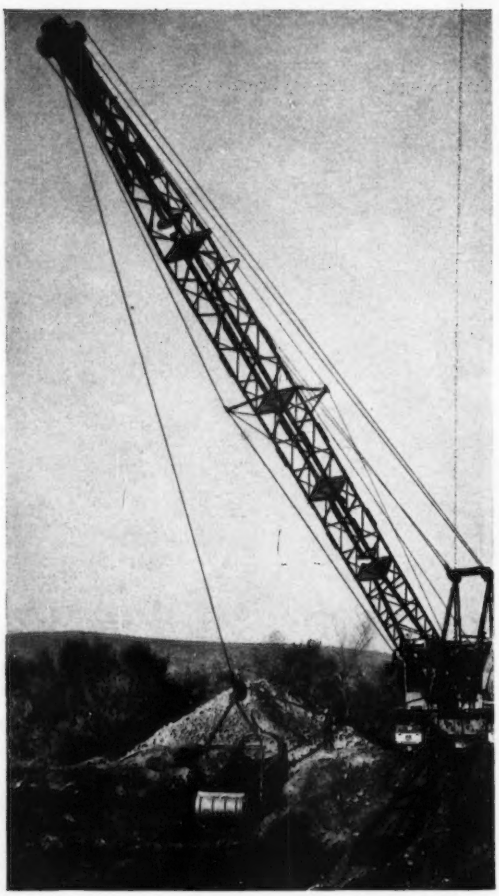


You PAY for the best . . . make sure you GET it . . . always specify Roebling

YOU PAY FOR THE BEST when you buy wire rope. And you *get the best* when you buy Roebling Preformed "Blue Center" Steel Wire Rope. "Blue Center" steel is an exclusive Roebling product . . . gives rope the extra toughness that spells long life . . . service economy that really counts. Besides that, Roebling Preformed always spools better . . . reduces vibration and whipping . . . doesn't tend to set or kink.

Roebling makes a wide range of wire rope . . . brings you the right construction, grade and size for top performance and economy on each installation. Have your Roebling Field Man help select the *best* rope for your particular requirements. And for maximum savings, get his suggestions on the proper use and maintenance of wire rope. He knows the case histories of thousands of installations. John A. Roebling's Sons Company, Trenton 2, New Jersey.

ROEBLING

Atlanta, 934 Avon Ave ★ **Boston,** 51 Sleeper St ★ **Chicago,** 5525 W. Roosevelt Rd ★ **Cincinnati,** 3253 Fredonia Ave ★ **Cleveland,** 701 St. Clair Ave, N.E. ★ **Denver,** 4801 Jackson St ★ **Houston,** 6216 Navigation Blvd ★ **Los Angeles,** 216 S. Alameda St ★ **New York,** 19 Rector St ★ **Odessa, Texas,** 1920 E. 2nd St ★ **Philadelphia,** 230 Vine St ★ **San Francisco,** 1740 17th St ★ **Seattle,** 900 1st Ave, S. ★ **Tulsa,** 321 N. Cheyenne St

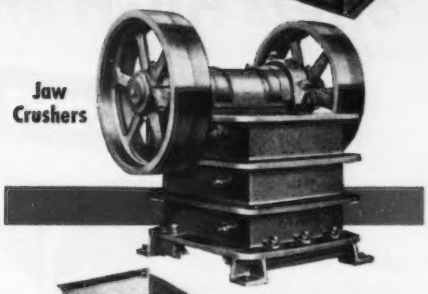
TELSMITH

feeding
coarse crushing
screening
fine crushing

EQUIPMENT FOR MINES

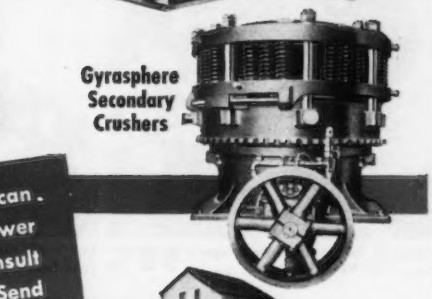
Heavy-Duty Feeders

Jaw Crushers

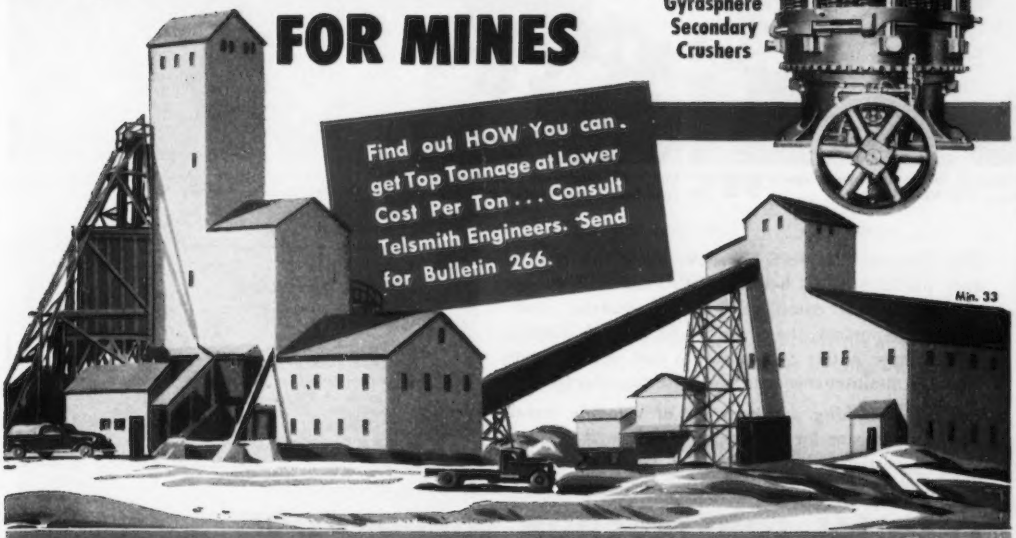


Vibrating Screens

Gyrasphere Secondary Crushers



Find out HOW You can get Top Tonnage at Lower Cost Per Ton . . . Consult Telsmith Engineers. Send for Bulletin 266.



Min. 33

SMITH ENGINEERING WORKS, 502 EAST CAPITOL DRIVE, MILWAUKEE 12, WISCONSIN

Cable Address: Sengworks, Milwaukee

Samuel Osborn (S. A.) Ltd. Johannesburg, So. Africa
Armco International Corp. Buenos Aires, Argentina
51 East 42nd St. New York 17, N. Y.
211 W. Wacker Dr. Chicago 6, Ill.
Mine & Smelter Supply Co. Denver 17, Colo.
Mines Eng. & Supp. Co., San Francisco 4, Calif.
Morrow Canada Ltd., Montreal, P.Q.
Gordon Russell, Ltd., Vancouver, B. C.

CHEMICO

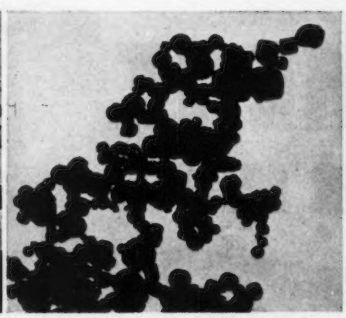
P-A VENTURI GAS SCRUBBER

offers HIGH *efficiency*

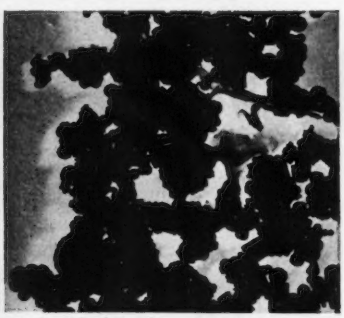
AT LOW COST

Typical efficiencies in the removal of sub-micron dusts

Activated carbon dust from rotary dryer. P-A Venturi Efficiency **98%**



Iron oxide dust from oxygen-lanced open hearth. P-A Venturi Efficiency . **99%**



Lead oxide fume from scrap lead blast furnace. P-A Venturi Efficiency . **95%**

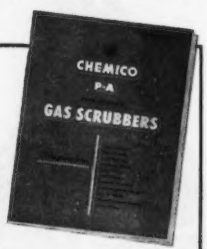
The Electron Micrographs above show the type of dust particles the Chemico P-A Venturi Scrubber removes almost completely from industrial gases. Equally important, the price of efficient P-A Venturi performance is *low* . . . in initial cost of the equipment, in maintenance and water requirements.

For gas scrubbing, for recovery of valuable metals and chemicals or for absorption of odors, it will pay you to investigate the Chemico P-A Venturi Scrubber.

NEW 8-PAGE BULLETIN

Fully illustrated Bulletin M-102 gives performance data and case histories on both the Chemico P-A Venturi and Cyclonic Gas Scrubbers.

Write for your copy today.



CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

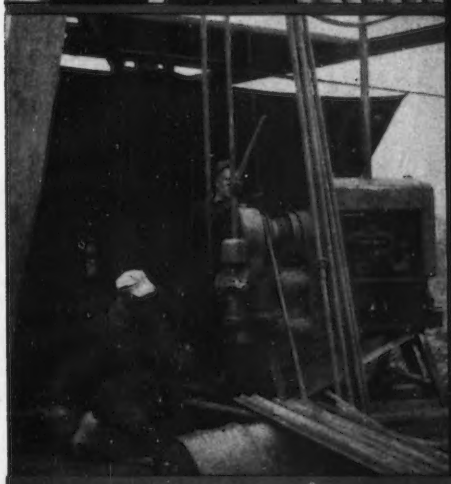
488 MADISON AVENUE, NEW YORK 22, N. Y.

EUROPEAN TECHNICAL REPRESENTATIVE
CYANAMID PRODUCTS, LTD., LONDON W. C. 2 ENGLAND
CABLES: CHEMICONST, NEW YORK

Chemico Plants are Profitable Investments

Service...

your interests of first importance—



There are **2** *ways of doing your diamond drilling*

One is to do it yourself.
The other is to contract it.

Doubtless you ask yourself "which is the better way for me?" The decision, of course, rests with you, but first consider how your own best interests will be served by contracting your drilling to Longyear. Here are some of the specific advantages:

1. Your job is studied from your viewpoint, and the objectives to be accomplished. Your interests are of first importance.

2. The right drill for efficient work will be selected for your job. This saves you an investment in equipment.

3. Experienced drill crews carry on under competent direction. They are resourceful in handling complex drilling problems. Competency saves you money, because delays due to inexperienced operators are eliminated.

4. Longyear improved coring equipment gives you the best core recovery possible in any given formation . . . *CORES TELL THE STORY.*

Decide to have Longyear demonstrate the above advantages on your job. Our Contract Drilling Division will respond to your call.

E. J. LONGYEAR COMPANY

MINNEAPOLIS, MINNESOTA, U.S.A. NEW YORK OFFICE, 1775 BROADWAY

CANADIAN LONGYEAR, LIMITED, NORTH BAY, ONTARIO, CANADA

DIAMOND CORE DRILLS • CONTRACT CORE DRILLING
SHAFT SINKING • GEOLOGICAL INVESTIGATIONS

REPRESENTATIVES IN PRINCIPAL MINING CENTERS IN THE UNITED STATES AND OTHER COUNTRIES

Cummins® Custom-built Diesels

Built not once but Twice

Best buy in power is the engine that's built best

Cummins Diesels have an outstanding record *and* reputation in a wide range of Diesel applications. And here's one reason!

Rugged, lightweight, high-speed Cummins Diesels perform better because they're built better, under strictest quality control methods. Moreover, each engine is actually built twice! After initial assembly, each engine is run in on the test block. Then it is torn down and carefully re-inspected — and after that it is re-assembled and tested *again*.

Such *extra* care in precision building . . . Cummins exclusive fuel system . . . reliable world-wide service and parts organization . . . enable Cummins users to get peak performance . . . less "down-time" and *more* rugged, dependable power.

Better contact your Cummins dealer. He has more facts to show you about making more profits.

Diesel power by CUMMINS

CUMMINS Dynamatic DIESEL

TRADEMARK REG. U.S. PAT. OFF.

CUMMINS ENGINE COMPANY, INC. • COLUMBUS, IND.

EXPORT: CUMMINS DIESEL EXPORT CORPORATION
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Lightweight High-speed Diesel Engines (50-550 hp) for: On-highway trucks • off-highway trucks • buses • tractors • earth-movers • shovels • cranes • industrial locomotives • air compressors logging yarders and loaders • drilling rigs • centrifugal pumps generator sets and power units • work boats and pleasure craft.

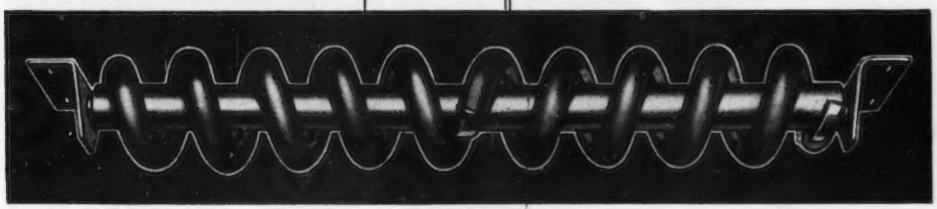
this record proves

THE RETURNS FROM REX SPIRAL RETURN IDLERS

COST RECORD (In a large western coke plant)

TYPE OF IDLER	Steel	Rubber Covered Spiral
SERVICE LIFE	3 months	12 months
COST 1st YEAR	$66.80 for 4	$47.70 each
SAVING 1st YEAR		$19.10
Cost of Replacement		
Subsequent Years (per year)	$66.80 for 4	$18.20 each (rubber covering)

SAVING per year after 1st YEAR $48.60



Yes, the cost record from *just* this one plant clearly demonstrates the savings possible through the installation of Rex Rubber Covered Spiral Return Idlers.

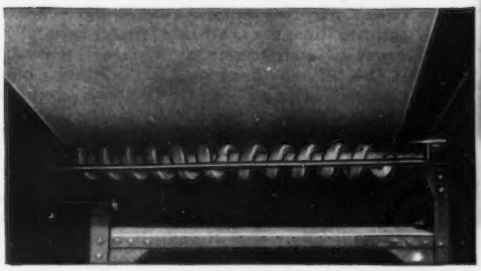
Before the installation of these cost-cutting idlers, the abrasive action of coke breeze clinging to the return side of the belts wore out the standard steel return idlers in an average 3-month period.

15 Rex Spiral Return Idlers were installed for trial and have given at least 12 months' service—4 times longer than the steel idlers. These idlers provide a constant, ever-changing point of contact between idler and belt, preventing build-up of material on the idler and, in some cases, helping to clean the belt.

Cost records show that the 15 Rex Spiral Return Idlers made possible a saving of $19.10 per idler and $286.50 total saving, including initial and installation costs. After the first year, the spiral rubber covering can be replaced, if worn, at a cost of $18.20 per idler. This cost as compared to $66.80, the cost of 4 new steel return idler rolls, indicates a saving after the initial year of $48.60 per year.

Add to these savings, the elimination of down-time caused by the frequent replacement of steel idler rolls, which makes the cost-cutting advantages of Rex Rubber Covered Spiral Return Idlers even more obvious.

Why not investigate the advantages of Rex Spiral Return Idlers and the other idlers in the Rex Line for your operations? Mail the coupon for your copy of Bulletin No. 463R.



Rex Rubber Covered Spiral Return Idlers installed in this western coke plant delivered 4 times longer service than conventional steel return idlers previously used.

CHAIN BELT REX COMPANY — BELT CONVEYOR IDLERS

Chain Belt Company 50-214
1679 W. Bruce Street
Milwaukee 4, Wis.

Please send me a copy of Bulletin 463R.

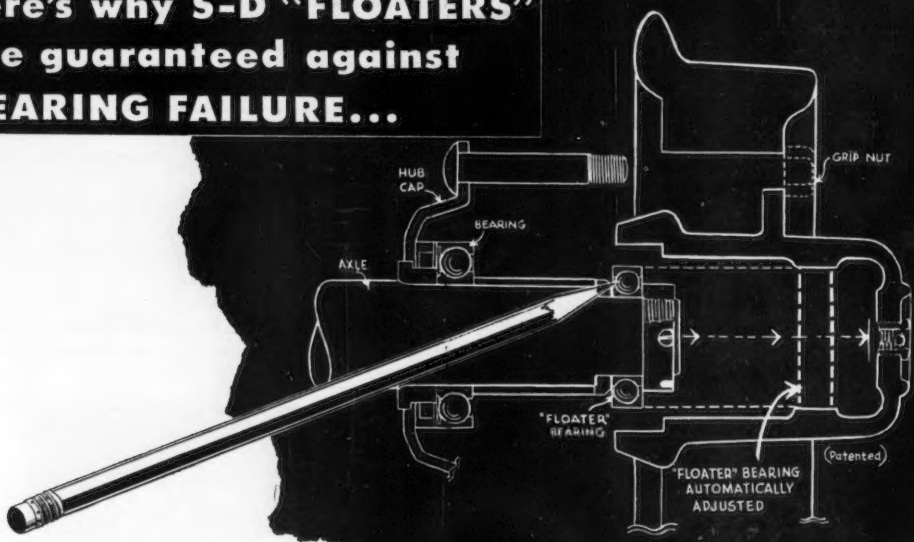
Name.....

Company..... *Dept*.....

Address.....

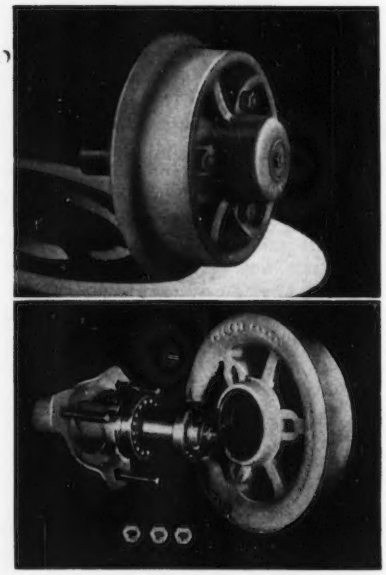
City..... *State*.....

here's why S-D "FLOATERS" are guaranteed against BEARING FAILURE...



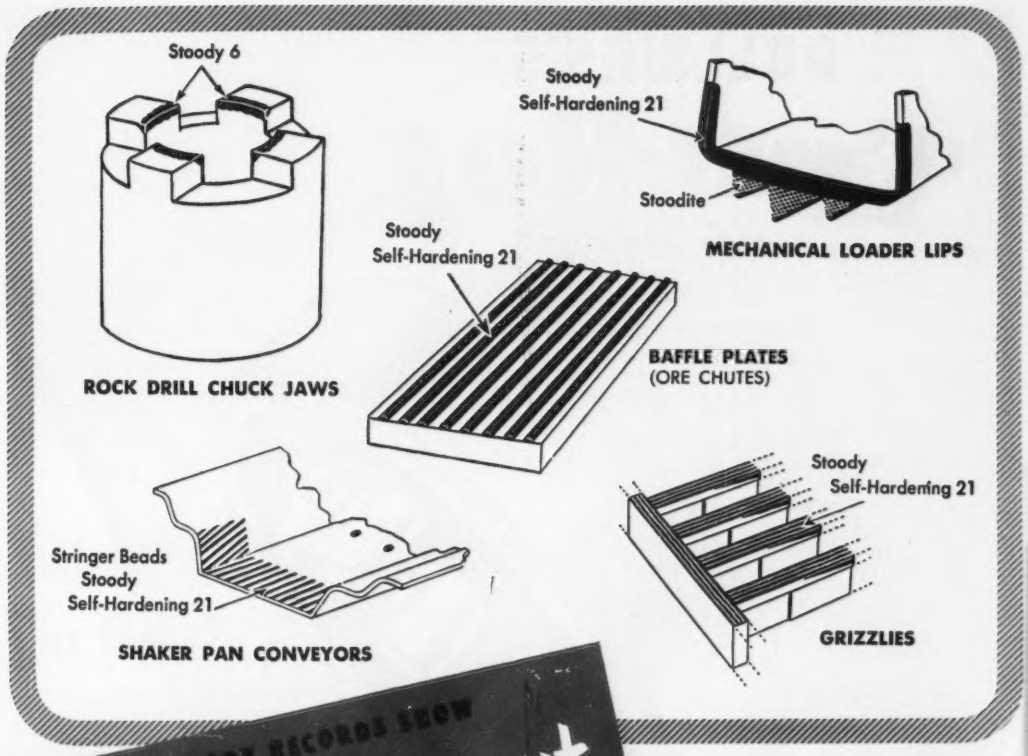
Proper bearing adjustment is automatic!

Because one of the two bearings "floats" into perfect adjustment, there are never any loose or tight bearings on S-D "Floater" Ball Bearing Wheels. That's why we can guarantee the "Floater" wheel against bearing failures for 5 years. Diagram above of a demounted "Floater" shows the heart of the wheel—that magic "floating" bearing that automatically adjusts itself when wheel is mounted and the three retaining bolts are pulled up tight. The extra large bearing absorbs all side thrusts and carries the bulk of the load. Any workman on the job can remove and replace a "Floater" Wheel because "Floater" bearings always remain in perfect adjustment on the axle whether the wheel is off or on. Remember, too, that "Floaters" have solid closed front hubs and positive back seals to keep foreign matter out and grease in! That's why so many "Floaters" often run 5 years and more on a single greasing. The S-D "Floater's" low cost of operation is certainly worth investigating. Without question, S-D "Floaters" run easier, run smoother and cost far less in maintenance than any other mine car wheel!



FOR COMPLETE INFORMATION, WRITE
SANFORD-DAY IRON WORKS, KNOXVILLE, TENN.

SANFORD - DAY IRON WORKS



STOODY RECORDS SHOW

It's never worn out Until it can't be hard-faced!

When you find new parts hard to get and you're having trouble making the old ones last, remember that a part is never worn out if it can still be Stoody hard-faced!

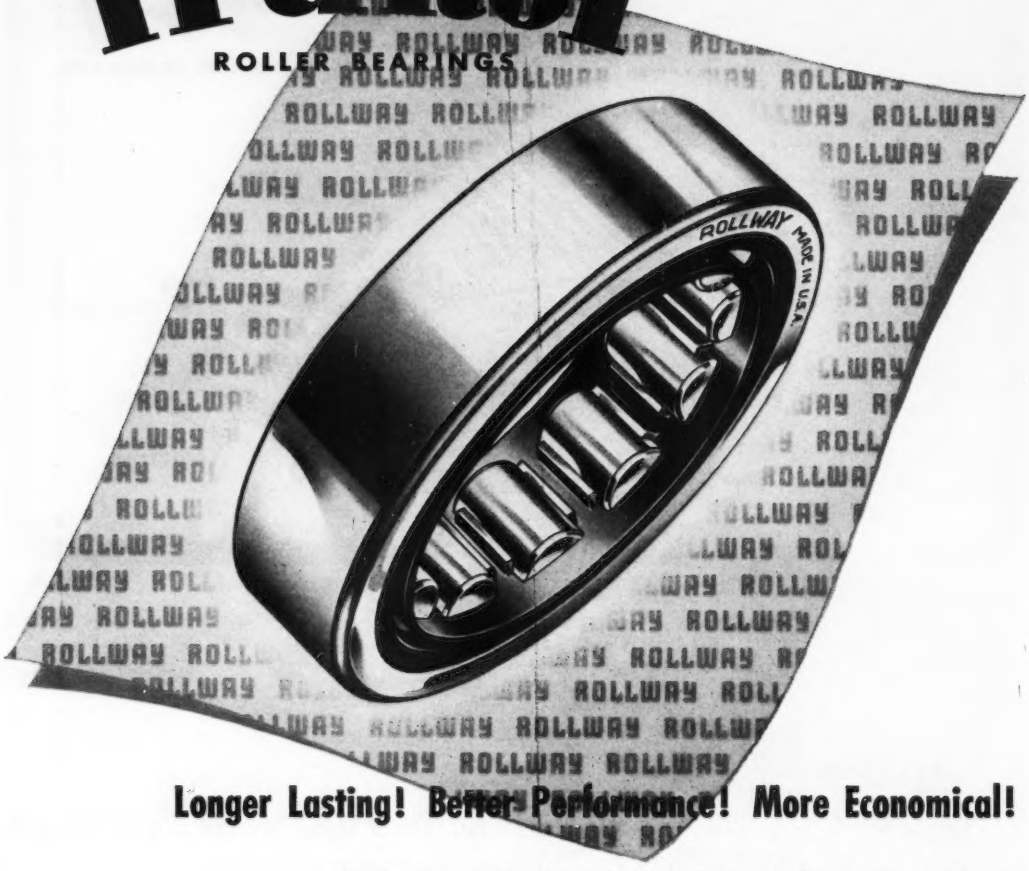
When wearing areas are protected with Stoody Alloys, new parts or old go back into service much longer lasting, *more downright wear-resistant* than factory originals! A few pounds of hard metal show unusual economies; frequently save tons of steel normally lost in abrasive wear. And when the hard-metal is finally worn off, it can be re-applied time after time. So, with Stoody hard-facing you're not only assured of lower maintenance costs, you're cinching a sure, steady supply of better-than-new replacement parts when new parts may no longer exist!

Ask your Stoody Dealer how to double the life of your mining equipment with Stoody Alloys. He will gladly recommend the one best Stoody Alloy for your job and proven application procedures.

STOODY COMPANY
11940 EAST SLAUSON AVENUE, WHITTIER, CALIFORNIA

ROLLWAY'S Tru-Rol

ROLLER BEARINGS



Longer Lasting! Better Performance! More Economical!

Here's a low-cost bearing that's an efficient companion to Rollway's famous bronze retainer bearings. It's been thoroughly tested and proved . . . gives remarkable performance where there has to be just the right balance between the economy and precision factors of bearing selection.

TRU-ROL Bearings feature Rollway's exclusive "Guide Lips"—curved, broad flanges in the steel retainer pockets that guide the rollers in perfect alignment and keep them properly lubricated.

TRU-ROL design and construction assure precision operation . . . and long, dependable service . . . *at a considerable saving.* Specify Tru-Rol . . . and obtain the high standards of workmanship and materials that have distinguished Rollway Bearings for more than 40 years.

Engineering Service . . .

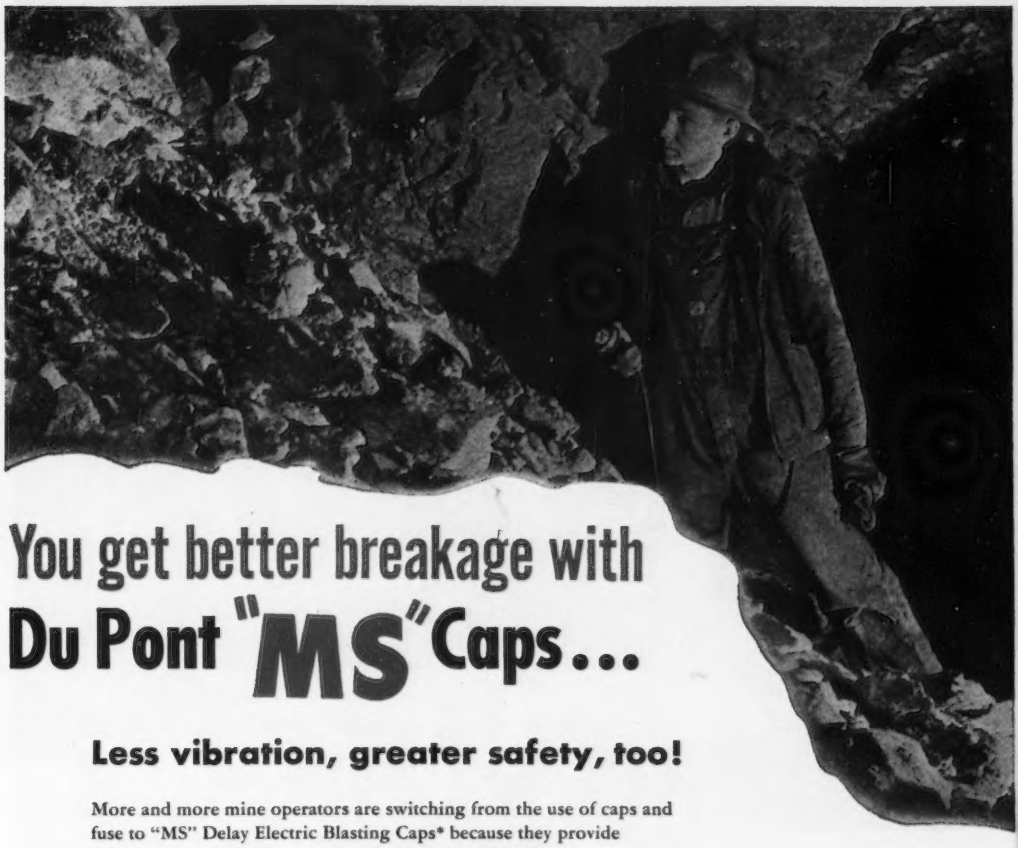
If you have a particular problem, contact us. A Rollway engineer will be available for consultation with you—without obligation, of course.

ROLLWAY

BEARING COMPANY, INC.

Syracuse 4, N. Y.

SALES OFFICES: Philadelphia • Boston • Pittsburgh • Cleveland Detroit • Chicago • Houston • Los Angeles



You get better breakage with Du Pont "MS" Caps...

Less vibration, greater safety, too!

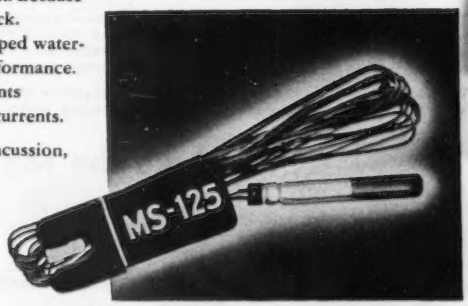
More and more mine operators are switching from the use of caps and fuse to "MS" Delay Electric Blasting Caps* because they provide superior fragmentation, greater safety and less vibration.

Even badly fractured veins break well when "MS" Delay Caps are used. And uniformly fine breakage makes slusher operation more efficient . . . reduces costly hand labor and secondary blasting.

Workers find "MS" Delay Caps as safe as they are efficient. Because of their short interval they leave no dynamite in the muck. Brightly colored nylon-insulated wires and double-crimped water-resistant rubber-plug closures make for dependable performance. Protective Cellophane-lined aluminum-foil-shielded shunts greatly reduce the risk of premature firing due to stray currents.

"MS" Delay Caps substantially reduce vibration and concussion, too. This results in less damage to pillar walls.

Get complete information about "MS" (millisecond) Delay Electric Blasting Caps today. Talk to your Du Pont Explosives representative or write: E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington 98, Delaware.



**Available in 14 millisecond intervals of delay: MS-25, -50, -75, -100, -125, -150, -175, -200, -250, -300, -350, -400, -450 and -500.*

DU PONT EXPLOSIVES

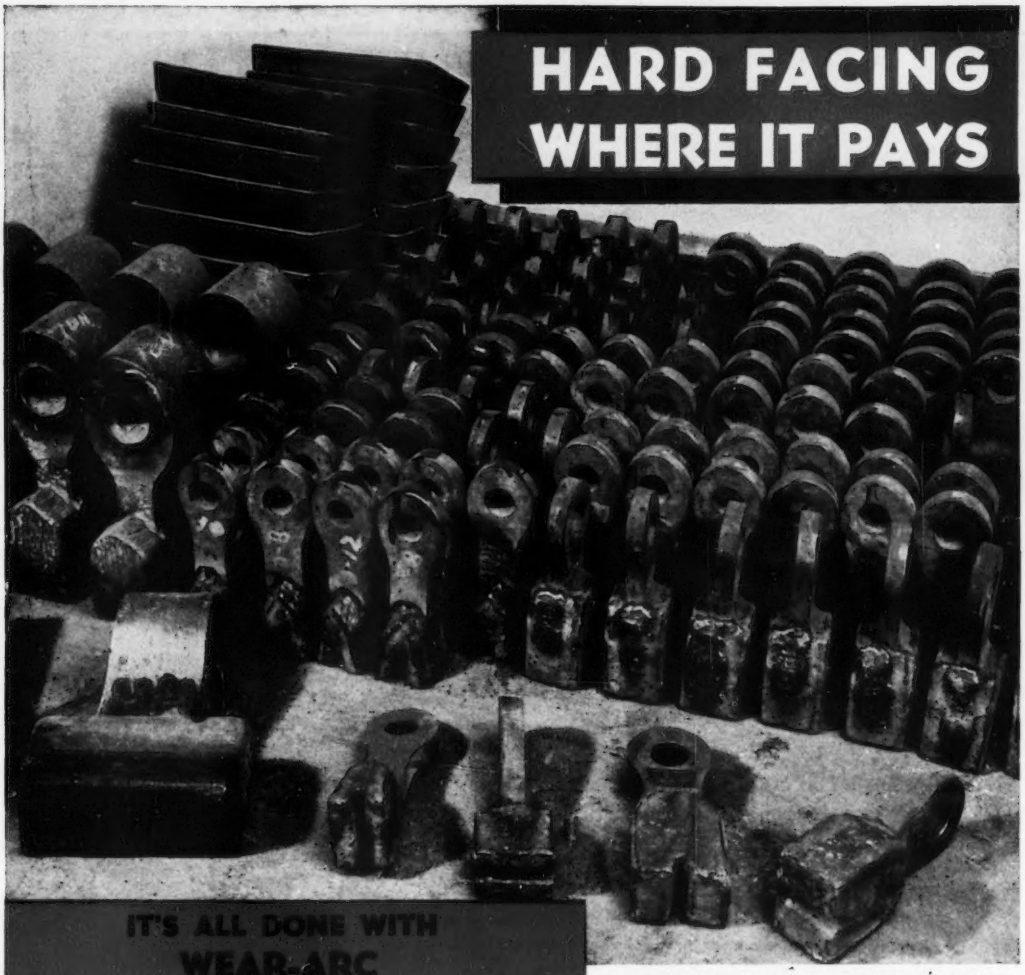
BLASTING SUPPLIES AND ACCESSORIES

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

HARD FACING WHERE IT PAYS



IT'S ALL DONE WITH WEAR-ARC

Elevator buckets of cast steel (annealed) are hard faced on the top wearing edge with WEAR-ARC 12 to increase life against impact and abrasion. Ninety-five pound hammers for the impactor, 10 lb. and 20 lb. hammers for the hammermills, and dipper and shovel teeth are all built up with WEAR-ARC WH and hard faced with WEAR-ARC 12 to increase life as much as three times under severe impact and abrasion.

To reclaim worn equipment and hard face against excessive wear, you will find one, or a combination of two, of the seven basic WEAR-ARC hard facing electrodes does the best job . . . increases life as much as four times or more.

WEAR-ARC WH is ideal for build up on manganese steel; WEAR-ARC 12 for providing that hard wearing surface.

Ask for bulletin No. 10550, illustrating and describing properties and welding procedures for the complete line.

"I Like the rod that comes in the RED can"

SEE YOUR NEAREST ALLOY RODS DISTRIBUTOR

ARCALOY for stainless steel
NICKEL-ARC for cast iron
TOOL-ARC for tool steel
WEAR-ARC for hard facing
BRONZE-ARC for general use

ALLOY RODS CO. York, Penna.

For greater

SPEED...

STABILITY...

SMOOTHER RIDING...

SPRING MOUNTED REAR-DUMP EUCLIDS

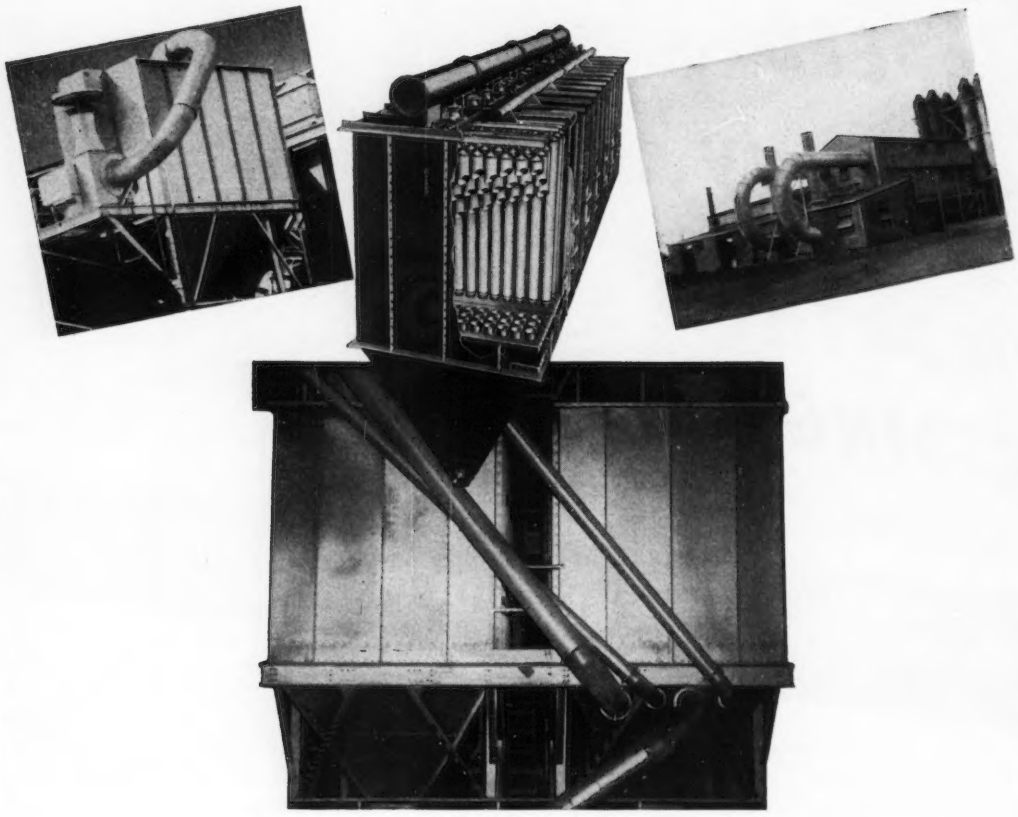
This new line of spring mounted Rear-Dump Euclids is designed for greater speed and stability on the haul road and long life in off-the-highway service. Heavy leaf springs are free floating in spring brackets to assure smooth riding and prevent breakage caused by twisting action on rough roads. Axles are positioned to the frame by longitudinal radius rods.

Rear-Dump Euclids with spring mounted drive axles range in capacity from 10 to 34 tons . . . diesel engines to 400 horsepower . . . and have travel speeds with full payload up to 35.7 m.p.h. Hydraulic booster steering assures positive control over all road conditions and reduces driver effort on sharp turns and rough hauls.

Built to the same high standards of construction and design that have made "Eucs" the favorite for tough hauling jobs, these improved models provide outstanding performance and lowest cost per ton or yard moved. Your Euclid distributor will be glad to show you how Euclid equipment can help cut your hauling costs and make more profit for you.

The EUCLID ROAD MACHINERY Co.
CLEVELAND 17, OHIO

EUCLIDS *Move the Earth*



Get A Bigger Profit From Your Dust Control

Of all the major types of dust and fume collection modern automatic bag type as developed by Norblo is the most widely useful and adaptable for heavy duty in large scale production processes. Norblo equipment is profitable to use, low in maintenance and operating cost.

Norblo bag type based on compartments of 78 cylindrical bags, progressively shaken, is adjustable for varying dust load without shutting down. The original planned efficiency of collection based on cloth area is as high as or higher than any other construction actually attained in practice.

Norblo automatic bag type dust and fume collection is fully described in Bulletin 164-2—write for it.

Norblo

Engineered Dust Collection Systems for All Industries

THE NORTHERN BLOWER COMPANY

6410 BARBERTON AVE. • CLEVELAND 2, OHIO

looking for a

tough mine power cable?

it's **ANACONDA BUTYL-INSULATED**

High Voltage Cable

No metal armor or lead sheath, yet . . .
There's even greater mechanical and electrical protection in the combination of *neoprene jacket* and *butyl insulation*.
Together they provide:
Unequalled protection from impact, crushing, twisting and abrasion.
Higher dielectric strength.
Greater resistance to moisture, acids, oils, ozone, heat and flame.
Less weight, more flexibility; easier to handle, install, splice and maintain. Lower first and final costs!

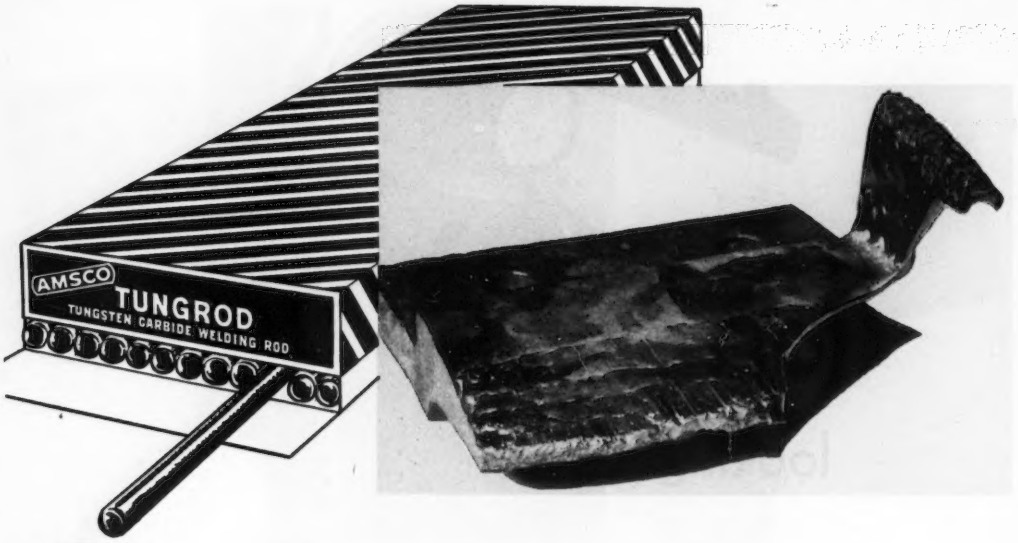
5134D

ANACONDA *Butyl-Insulated High Voltage Cable is the modern cable for any mine—particularly mechanized mines. Anaconda also specializes in the manufacture of shuttle car cable and cable for the new continuous mining machines. Let our mine service specialists show you, or get in touch with your near-by Anaconda Distributor. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.*

the right cable for the job

ANACONDA®

WIRE AND CABLE



Saved HUNDREDS OF DOLLARS PER MONTH IN PULVERIZING!

An example of how the AMSCO Hardfacing System can help you fight wear profitably

Here's why the AMSCO HARDFACING SYSTEM can save you money

Hardfacing recommendations are as sound as the manufacturer who makes them. For a half-century, Amsco has specialized in fighting the high cost of wear—first with manganese steel and later with another big weapon . . . AMSCO Hardfacing Rods and Electrodes.

The result is the AMSCO Hardfacing System . . . where a wide range of Amsco Rods are selected for use according to a systematic appraisal of the equipment part and wear factors involved.

Whether your particular problem is one of wear caused by impact, abrasion, heat, corrosion—alone or in combination . . .

Amsco has both the research facilities and the years of on-the-job experience necessary to help you make important reductions in your operating costs.

A large Pennsylvania brick company was faced with this problem: their pulverizer plows wore out every two weeks due to extreme abrasion of clay with a high silica content. An expensive period of down-time and replacement labor resulted.

In trying to stop this high replacement cost, a test was made. Each plow was hardfaced with AMSCO Tungrod—specially developed by Amsco research for high resistance to abrasive wear.

Result? The plows hardfaced with AMSCO Tungrod lasted 4 times as long . . . 3 out of every four replacement jobs were eliminated! The saving amounted to several hundred dollars *each month*!

AMSCO Tungrod permits big savings—through longer service and fewer replacements—on many other applications. If you have an equipment part used in cutting or pulverizing non-metallic materials, the possible savings—*to you*—are too big to be overlooked!

Write today for illustrated hardfacing catalog — and nearest distributor's name.

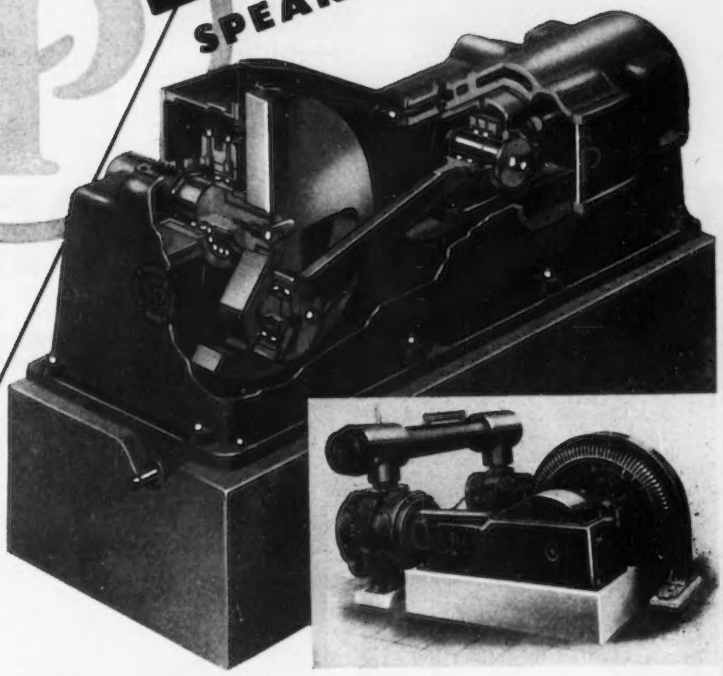
AMSCO®
WELDING PRODUCTS

AMERICAN **Brake Shoe** COMPANY

AMERICAN MANGANESE STEEL DIVISION
376 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que.

THIS STATEMENT BY THE CHICAGO PNEUMATIC TOOL COMPANY SPEAKS FOR ITSELF

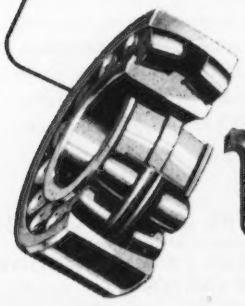


"The Class O-CE Chicago Pneumatic Horizontal Duplex Motor-Driven Compressor is the first to have anti-friction roller bearings throughout. This big advancement in compressor design utilizes SKF Spherical Roller Main and Crankpin Bearings . . . this innovation in side-crank compressor design is made possible by SKF's recent development of the Oil Injection Method of bearing installation and removal.

"With anti-friction bearings many advantages are evident. Reduced maintenance time and costs, one-piece connecting rods and crank discs, a flood lubrication system and no possibility of improper bearing adjustments are among these."*

Once again SKF, by helping put the right bearing in the right place, has contributed to the engineering of more efficient equipment designed to give more dependable and economical service.

7212



8 REASONS WHY SKF IS PREFERRED BY ALL INDUSTRY

integrity
craftsmanship
metallurgy
tolerance control
surface finish
product uniformity
engineering service
field service

* For detailed information on Chicago Pneumatic Tool Company Compressors and other equipment write Chicago Pneumatic Tool Company, 6 E. 44th Street, New York 17, N. Y.

SKF

BALL AND ROLLER BEARINGS

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.
—manufacturers of SKF *and* HESS-BRIGHT *bearings.*

See Louisville for
CREATIVE
DRYING
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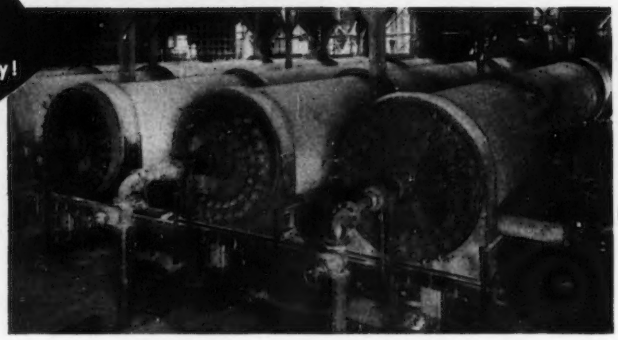
LOUISVILLE DRYERS
pay their way

KNOW THE
RESULTS
Before You Buy!



Savings sometimes can't be evaluated in dollars but they are there just the same.

A large company decided to investigate the possible advantages of refining a mined product at its source instead of hundreds of miles away. The purpose was to eliminate considerable freight on water as well as shipping a great quantity of unusable material.

A process was developed which greatly reduced the amount of rejects but it required unusually careful handling in the drying. The problem was presented to a Louisville Drying specialist. The correct answer was found in Louisville's unique research and development laboratory. The full-size installation was designed and installed with confidence of complete success—because it was proven correct in advance in Louisville's pilot plant.

Obsolete methods may be reducing your profits. Ask for a Louisville engineer to survey your drying processes. There's no obligation.

Other General American Equipment:
Turbo-Mixers, Evaporators, Thickeners, Dewaterers, Towers, Tanks, Bins, Filters, Kilns, Pressure Vessels

PROCESS EQUIPMENT DIVISION
GENERAL AMERICAN
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GENERAL AMERICAN TRANSPORTATION CORPORATION
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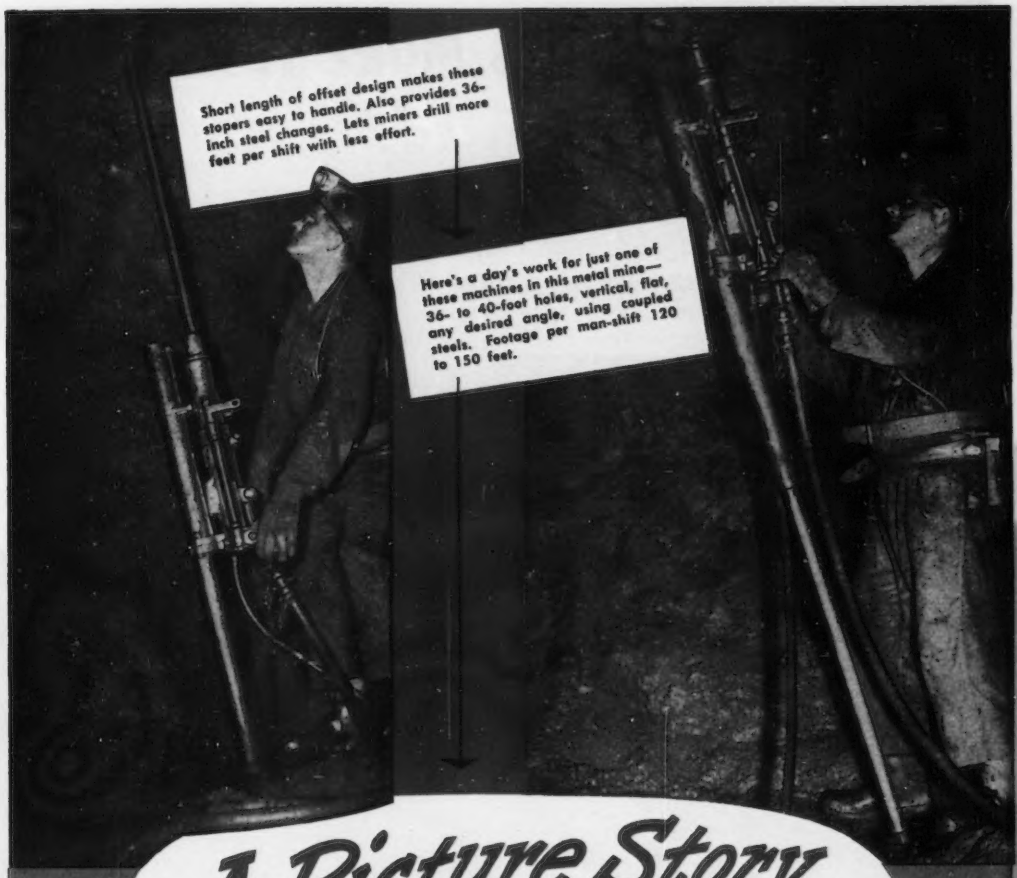
Short length of offset design makes these stopers easy to handle. Also provides 36-inch steel changes. Lets miners drill more feet per shift with less effort.
Here's a day's work for just one of these machines in this metal mine—36- to 40-foot holes, vertical, flat, any desired angle, using coupled steels. Footage per man-shift 120 to 150 feet.

A Picture Story of Lower Stoping Costs

. . . shows how Le Roi-CLEVELAND offset stopers drill extra footage, save you money

Take a good look at these pictures. Note the length of the drill steel. Fitted with carbide-tipped bits, it gives you 36" of drilling—3 feet with every change.

That's one of the reasons why Le Roi-CLEVELAND offset stopers are paying off in lower drilling costs.

But it's not the whole story. The machines shown here are equipped with downstroke rotation. This gives plenty of power and lets the miners drill holes from 36 to 40 feet in depth — using coupled steel. Total footage drilled per man-shift runs from 120 to 150 feet.

Performance like this does a lot to keep costs down. It also accounts for the growing popularity of Le Roi-CLEVELAND offset stopers wherever stoping is a problem.

Other features of these machines are: Removable water tube — no need to dismantle the machine. Graduated feeding pressure. Constant blowing at chuck keeps machine clean. Write us today for complete details.

LE ROI COMPANY

RD-33

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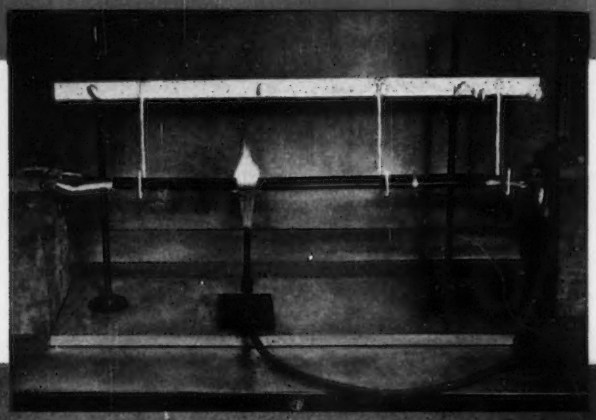
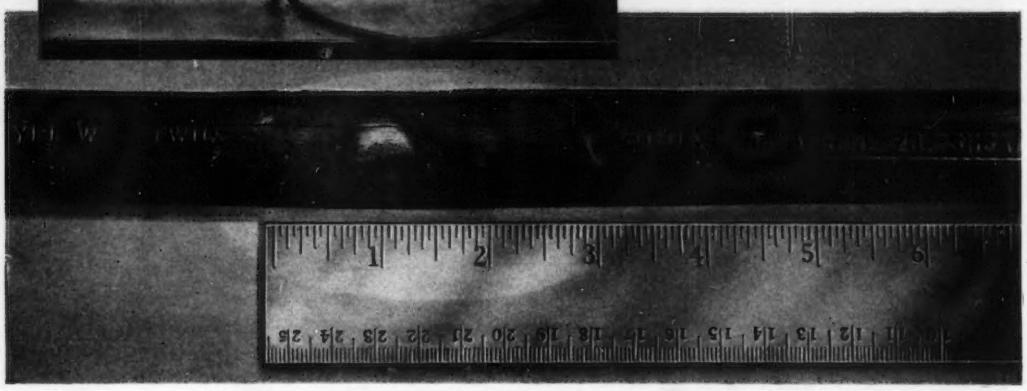
HAZACORD CABLES MORE THAN MEET NEW FLAME TEST LIMITS



New flame-resistance test of U. S. Bureau of Mines and Pennsylvania Department of Mines reduces the flame propagation limits from 14" to 6". Burning time is limited to 5 minutes. Complete set-up as required by new test procedure is pictured in Hazard's research laboratory.



Hazacord Twin Parallel Mining Machine Cable after typical flame test under the new, more rigid requirements. Flame propagation measures approximately 3½". There was no burning of the cable after the flame was removed.

The safety requirements of the new flame test for trailing cables recently announced by the U. S. Bureau of Mines and Pennsylvania Department of Mines are about twice as difficult to meet as formerly.

Hazaprene ZBF sheathed Hazacords amply pass the new test requirements. Exceptional flame-resistance has long been one of the outstanding features of Hazacords. Combined with this quality are many other advantages engineered into Hazacord inside and out to assure you safer, longer, and more economical service with trailing cables and cords.

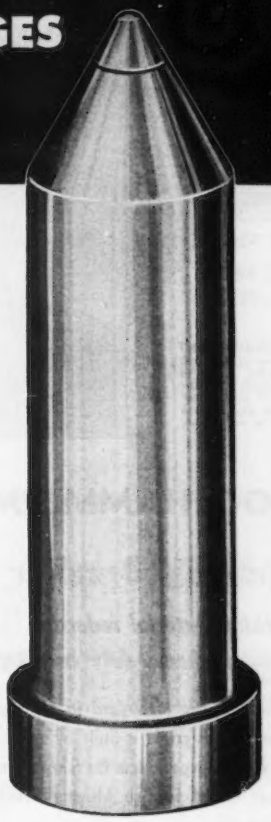
For example, the Hazaprene ZBF Sheath is also made *tough*—pressure-cured in a continuous metal mold for maximum density, snag-resistant surface smoothness, extra long-life even in the most punishing service. And there is no worry about oils, acids, chemicals, or water reducing the life of Hazacords.

Talk to your Hazard representative about Hazacord trailing cable and cords for your mine or write to us directly. There's a special Hazacord for every need. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD insulated wires and cables for every mining use

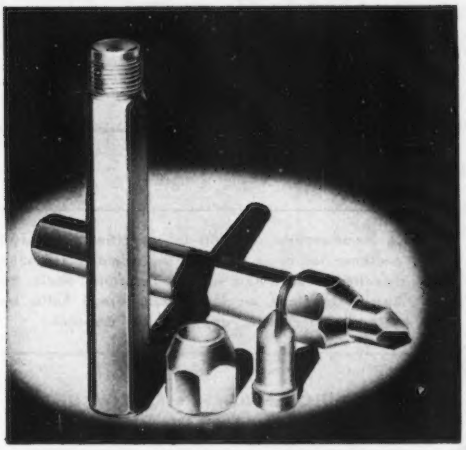
NOW A SAMPLING MOIL

WITH ALL THE ADVANTAGES OF A DETACHABLE BIT PLUS TUNGSTEN CARBIDE TIP



Hayes

Quickly attached or detached from the shaft, and with a working life forty or fifty times longer than ordinary moils, the Hayes Carbide Tipped Sampling Moil offers terrific time saving possibilities. "By far the best tool we have ever seen in cutting through quartz" reports one big gold producer. Mail the coupon below for more information.



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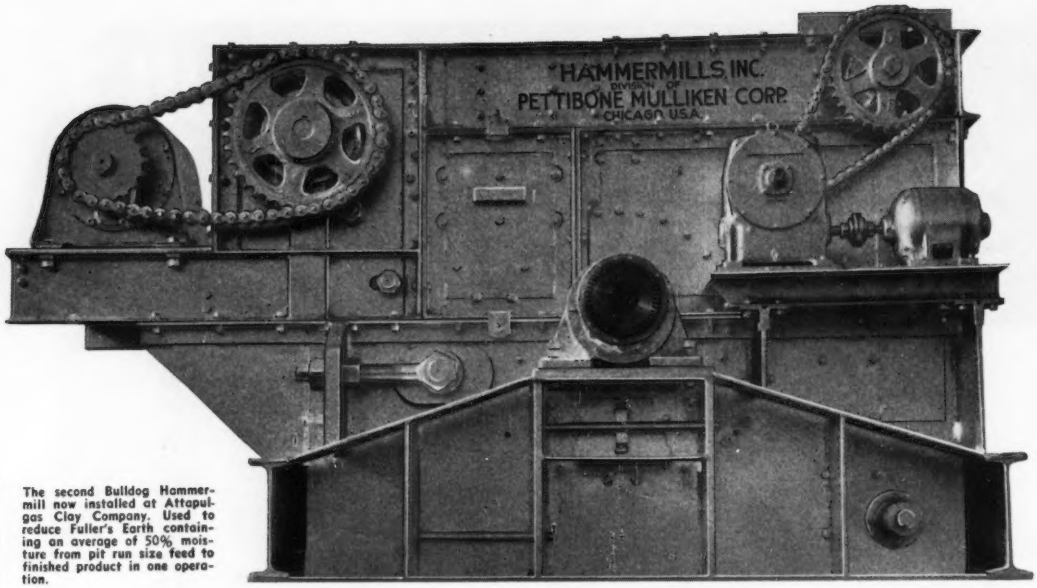
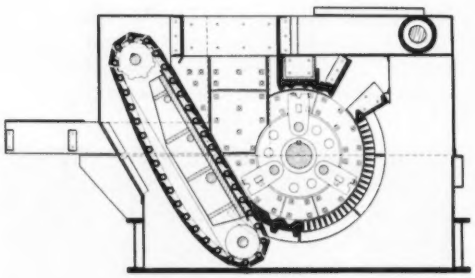


The second Bulldog Hammermill now installed at Attapulgas Clay Company. Used to reduce Fuller's Earth containing an average of 50% moisture from pit run size feed to finished product in one operation.

BULLDOG HAMMERMILL

with moving Breaker Plate

For wet, sticky material reduction . . . for those tough, heavy-duty crushing jobs.



Illustrated above is the last word in Moving Breaker Plate Hammermill design. It is built by an engineering organization whose experience far surpasses any organization that might furnish Moving Breaker Plate crushing equipment.

Design Improvements have increased reduction efficiencies and lowered H.P. requirements. You can see this equipment in operation at any time. Also Hammermills will gladly survey your reduction requirements and recommend the proper equipment without cost or obligation. Just write or call.

Bulldog Hammermills are built in capacities up to 1000 tons per hour for every purpose: for primary, secondary, fine reduction of materials such as limestone, shale, Fuller's Earth, phosphate muck, phosphate mud balls, iron ore, oyster or clam shells, any reducible material.

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So many opinions, so few real facts on abrasive wear! Here are figures of long-time tests from actual ore-grinding practice.

Write for 32 pp reprint of an informative paper published by the Amer. Inst. of Mining and Metallurgical Engrs., giving results of wear tests on grinding ball materials—FREE!

Case No. 5

Tests at a large mine grinding low-grade copper ore.

Service: Marcy 10′ × 10½′ grate discharge type ball mills grinding minus ¾″ feed to 84% minus 100 mesh. Mill speed 18 rpm. Balls charged were 2½″ and 2″ dia.

Comparison: Between one set of austenitic manganese steel grates in concurrent service with chromium-molybdenum cast steel grates, (normalised and tempered to 275 brinell).

Grate Type: Marcy design cast steel with slot openings ¾″ to ⅞″ wide.

Results:	Life—Days	Tons—per set
Manganese Steel	323 *	590,703 *
Cr-Mo Steel (ave.)	402	739,242

* Manganese steel grates removed before completely worn out, due to excessive peening of the bars, which closed-up the slot openings.

Case No. 6

Tests at a large mining operation grinding copper ore.

Service: Marcy 9½′ × 12′ rod mill grinding minus 2″ feed to minus 10 mesh. Speed 16.6 rpm. Replacement rods were 3″ dia.

Comparison: Between one set of martensitic (Ni-Hard) liners and one set of high carbon chromium-molybdenum cast steel liners, (salt quenched and tempered to 350 brinell).

Liner type: Shell (barrel) liners with specially designed square corner lifter.

Results:	Tonnage ground
Martensitic white iron	348,000 *
Cr-Mo Steel	404,426

* Several liner plates in this set replaced due breakage before remainder were worn out.

Climax Molybdenum Company
500 Fifth Avenue · New York City

Please send your FREE Reprint on "Wear Tests"

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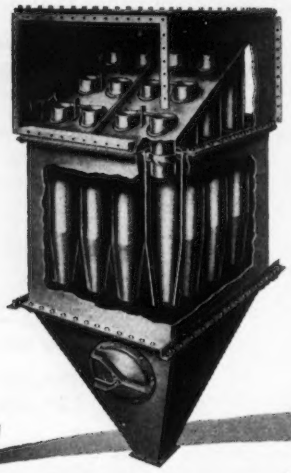
MOLY

C14

EM4

Before you buy *any* equipment for recovering dust or fly ash . . .



COMPARE ALL OTHERS against MULTICLONE'S Multiple Advantages

Because the advantages of MULTICLONE are so clear-cut, so vitally important, so far-reaching in the savings they make, we urge you to make a factual unbiased comparison of MULTICLONE dust and fly ash collection equipment against *any other* in the mechanical recovery field. Only by making such a comparison can you fully appreciate the major savings and greater performance you get by installing MULTICLONE Collectors!

COMPARE Recovery Efficiency!

It is a recognized fact that the separating efficiency of a cyclonic tube increases as the tube diameter decreases because smaller tubes generate greater centrifugal forces. The patented vane in the MULTICLONE makes the use of small tubes *practical* without complicated manifolding and permits compacting many small tubes into one simple, highly efficient unit. MULTICLONE's higher centrifugal forces throw out not only the large, medium and small particles, but also an unusually high percentage of the *extremely small* particles of 10 microns and less. Result—*more complete recovery of all suspended particles from the gas stream!*

COMPARE Space-Saving Compactness!

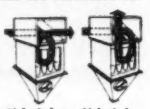
Plant space costs money—particularly at today's high construction costs. Because the MULTICLONE is more compact, size for size, it makes *really important* savings in space and plant costs. Note in the chart how the MULTICLONE requires substantially less space—*both in floor space and cubic space*—than any other unit of comparable capacity and performance. *This means vital savings in construction costs!*

Make	Relative Space Requirements In Sq. Ft.	In Cu. Ft.
Multiclone	1.0	1.0
Collector A	2.1	1.8
Collector B	5.9	3.2
Collector C	6.8	3.9

COMPARE Dollar-Saving Adaptability!

Savings in space is just one of many ways MULTICLONE reduces installation costs. Because the shape of the unit can be readily varied (long and narrow, short and wide, or square) to fit available spaces, the MULTICLONE can often be tucked into odd corners and waste areas too restricted for other equipment.

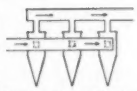
Moreover, inlet-outlet ducts can be varied—side-inlet side-outlet, or side-inlet top-outlet—to meet low headroom or restricted side clearance requirements . . . and the single-inlet single-outlet duct design permits greater flexibility and simpler installation. *These all add up to vital savings in installation costs!*



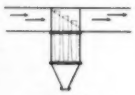
Side inlet, Side outlet *Side inlet, Top outlet*

COMPARE All-Around Simplicity!

The MULTICLONE is simple and inexpensive to maintain because there are no highspeed moving parts to repair or replace . . . no pads or filters to clean or renew . . . nothing to choke the gas flow or increase draft losses as suspended materials are recovered. In addition, the square, flat-sided shape of the MULTICLONE and its straight inlet and outlet ducts are far simpler to install and insulate. And since the recovered material from an entire bank of tubes is collected in a *single* hopper, it is much easier to service and maintain than the multiple hoppers of conventional cyclone units. *Here again, the MULTICLONE saves in many ways—all of them important!*

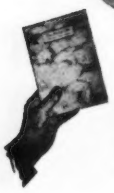


Conventional Cyclone



Multiclone

Whether your recovery installation is in a new structure or for modernizing present equipment, you will be far ahead by installing MULTICLONE Collectors. Our experienced engineers will gladly make helpful suggestions for simplifying your recovery problems. A letter, wire or call to our nearest office places this assistance at your service without obligation.



Send for Helpful Literature! This factual MULTICLONE literature explains the basic principles of cyclonic dust recovery and gives technical data helpful to anyone contemplating a dust or fly ash recovery installation. Write today for your free copy!

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a combination of Virgin Wool and DYNEL...

The RIGHT filter cloth for your job is now available in Portland Woolen Mills' new, longer-lasting **FUMEALL** filter fabric. Now in use by leading smelters, **FUMEALL** marks the high spot in Portland Woolen Mills' 50th Anniversary Year.

COMPARE THESE FEATURES WITH YOUR PRESENT FILTER FABRIC:

How Long Does It Last?
In actual operational tests, **FUMEALL** lasts at least 3 times as long as conventional all-wool filter fabric; on accelerated tests, 6 times as long.

Does It Have the Right Porosity?
You get exactly what you want with **FUMEALL**: the RIGHT weave for the specific job required. At present, **FUMEALL** is available in 5 different weights—from the most porous 14-oz. to the least porous 24-oz. If you need a finer or coarser weave, you can have that, too. **FUMEALL** may be napped or unnapped to vary the length of run between clearings.

Does It Have Resistance to Moisture?
In intermittent filtering operations, **FUMEALL** moisture absorption is 50% less than conventional all-wool fabrics. This prevents considerable weight-gaining due to excess moisture accumulation.

Is It Resistant to Acids, Alkalies and Heat?
FUMEALL filter fabric is superior because it combines the proved filtering properties of virgin wool and the acid, alkali and heat-resisting qualities of **DYNEL**, a new synthetic fiber developed by *Carbide and Carbon Chemicals, Division of Union Carbide.*

Tests to date show that **FUMEALL** operates perfectly in heat ranges up to 350° under certain acid and alkali conditions. Further tests are now being made in higher temperature ranges.

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FUMEALL is "tailored to your needs" right in the mill. We weave bags or yardage to any size you require!

WRITE OR TELEPHONE FOR ADDITIONAL INFORMATION

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Portland Woolen Mills, INC. PORTLAND 3, ORE.

*Patent Pending

NOW—Simpler, Faster, Automatic Titrations!

The BECKMAN Automatic TITRATOR

Here's another new Beckman advancement in instrumentation—*an instrument that runs your titrations for you.* It's the Beckman Automatic Titrator—the instrument that makes accurate titrations more rapidly and conveniently than by manual methods.

SIMPLE OPERATION: In a series of titrations, simply fill the burette, place the sample in the beaker—and the Beckman Automatic Titrator takes over from there. Raising the beaker holder into position automatically starts the stirrer motor and begins delivering titrating solution into the sample.

A special circuit electrically anticipates the approaching end point, scaling down delivery of the titrating solution in progressively smaller increments to assure a highly accurate titration. When the end point is reached, delivery of the titrating solution stops and a light shows completion of the titration—*all automatically and without attention from the operator.*

Whether your laboratory is large or small the Beckman Automatic Titrator provides important advantages in your titrating operations...

- *It releases the technician during titration, enabling him to perform other operations such as preparing samples, or calculating results.*
- *It eliminates the fatigue caused by close observation required in manual procedures.*
- *It gives objective, reproducible results... eliminates errors due to personal factors.*
- *It provides time-saving conveniences for sample handling.*

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ALSO A RELIABLE pH METER—the Beckman Automatic Titrator can also be used as an AC-powered pH meter to give accurate readings over the range 0 to 14 pH, as well as millivolt readings from −600 to +1400 mv.

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- CHEMONITE gives permanent protection to all wood products.
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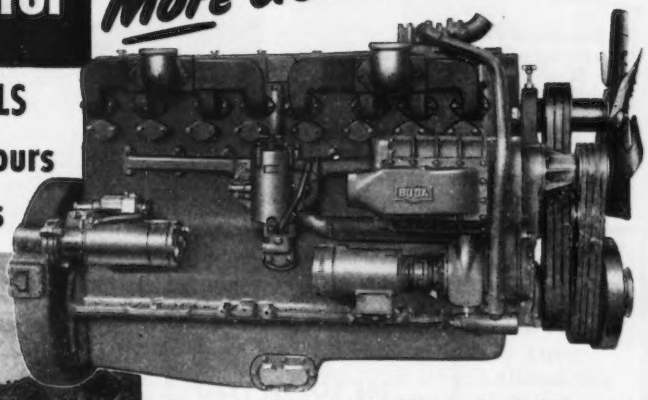

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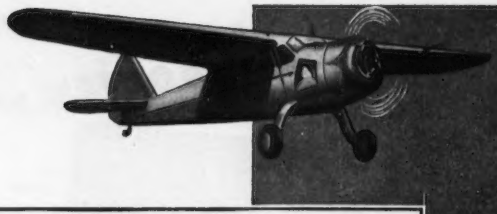

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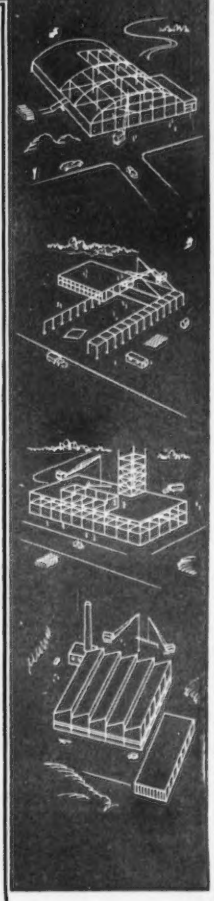

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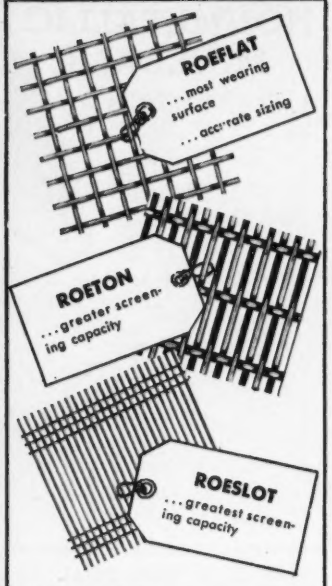

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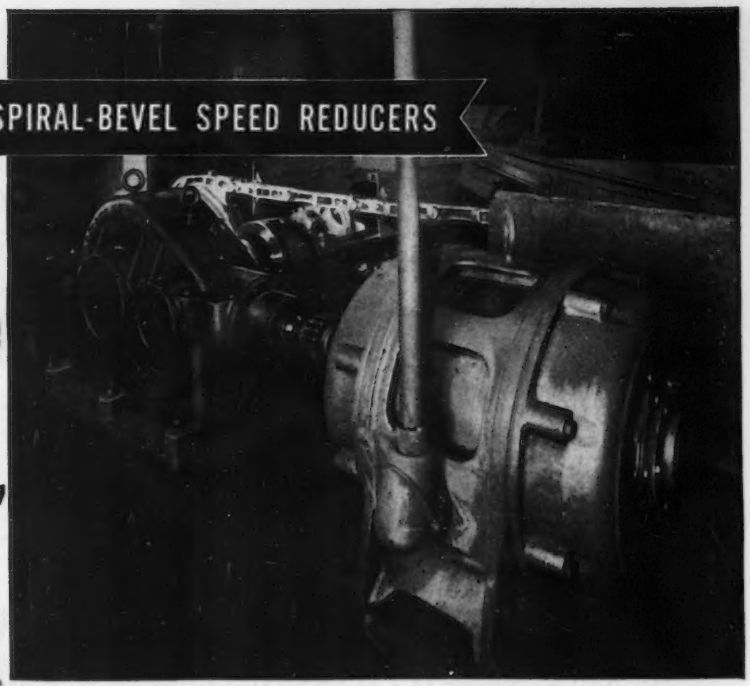

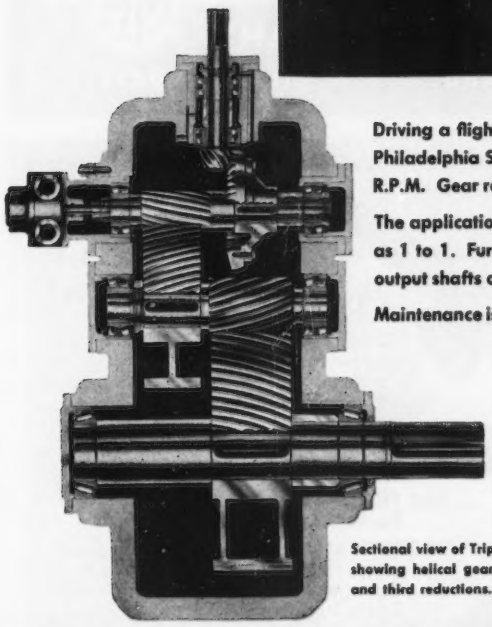

Sectional view of Triple Horizontal Unit showing helical gears used on second and third reductions.

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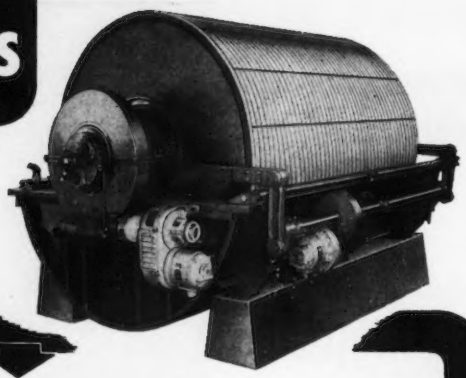

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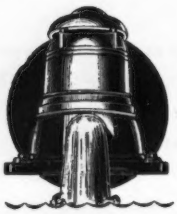

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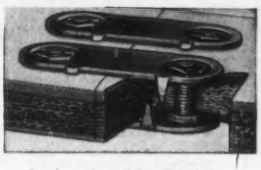

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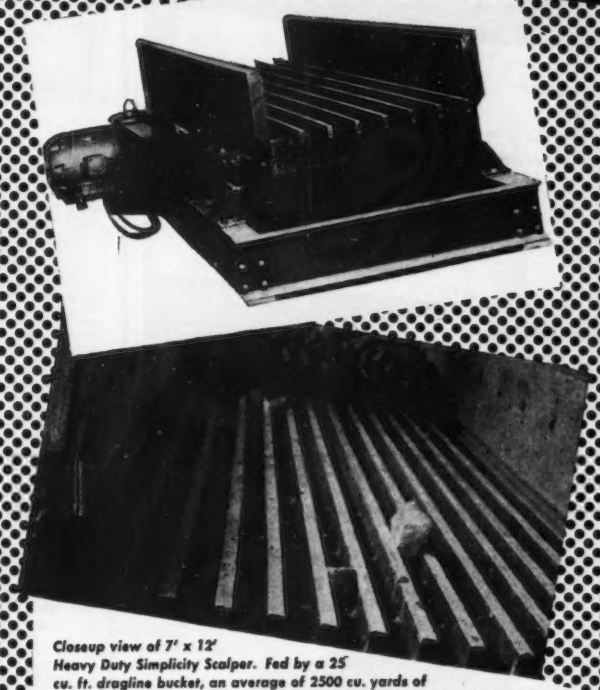

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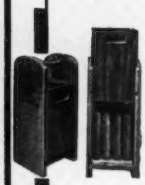


EXPLOSIVE BOXES

Approved by the Pa. Dep't. of Mines, these rigid non-conductive explosive boxes represent a prime safety investment. Made entirely of wood—tongue-grooved and dovetailed construction . . . no metal parts. . .automatic lock. . .rubber band spring . . . moisture-resistant. Box sizes are based on 1¼" x 8" sticks.

POWDER BOX PRICES ARE AS FOLLOWS:

No. 9	$2.55 ea.	No. 25	$5.10 ea.
No. 12	2.95 ea.	No. 36	6.50 ea.
No. 16	3.45 ea.	No. 50	7.60 ea.
No. 20	3.90 ea.	No. 72	8.70 ea.

DETONATOR BOX PRICES ARE AS FOLLOWS:

No. 6, size 2½" x 3" x 6" inside..$2.15 ea.
No. 8, size 2" x 2½" x 8" inside.. 2.15 ea.

WOOD TAMPING POLES

For Tamping Explosive Shots: Poles are round, made of Hardwood. Sizes to 10' long. Price per lineal ft.: 1" dia. 8c; 1⅛" dia. 12c; 1¼" dia. 14c; 1⅜" dia. 16c; 1½" dia. 18c; 1¾" dia. 28c; 2" dia. 32c. Special diameters and lengths can be furnished. These Poles meet the requirements of the New Federal Mine Safety Code.

SECTIONAL TAMPING POLES

These poles are made of straight grained wood and are coupled together with removable wood pins held in place in recessed grooves by a rubber band and can be quickly connected and unconnected.

Couplers and Head Blocks are 4, 5 and 6 inches in diameter. Please specify size when ordering. Poles are 1½" in diameter.

Head Blocks, $3.70 ea.; Couplers, $3.90 ea.; Poles 12 feet long, $3.60 ea.; Poles 14 feet long, $4.20 ea.; Poles 16 feet long, $4.80 ea.; Poles 18 feet long, $6.30 ea.; Poles 20 feet long, $7.00 ea.; Poles 22 feet long, $8.80 ea.; Poles 24 feet long, $9.60 ea.

J. V. HAMMOND CO., Spangler, Pa.

We also manufacture Shot Firing Units, Wooden Mallet and Wedge Sets, Trolley Poles, Sounding Sticks, Mine Rollers, Insulation Blocks and Brake Blocks

CORE DRILLING

"We look into the Earth"

—anywhere!

- Mineral Prospecting
- Foundation Test Borings and Grouting
- Large diameter holes for Ventilation and Escapeways

PENNSYLVANIA Drilling CO.

DRILLING CONTRACTORS & MFRS.

1205 Chartiers Ave. PITTSBURGH, PA. WAlnut 1-5816

DIAMOND CORE DRILLING

Contractors

Electric, AIR & GASOLINE DRILLS

FOR TESTING ALL MINERAL PROPERTIES

Pressure Grouting for Mine Shafts and Wet Entries

Inside Mine Drills, Drainage Holes

MOTT CORE DRILLING CO.

Huntington, W. Va.

Tungsten—Mercury—Uranium!
Find VITAL WAR METALS!
with Ultra-Violet
MINERALIGHT

MINERALIGHT instantly identifies tungsten, mercury and many other valuable minerals now in demand for rearmament.

FREE

5 MINERALIGHT models for every requirement. Money-back guarantee.

Send for *free* brochure—EM—on "Prospecting for Scheelite (tungsten) with Ultra-Violet."

ULTRA-VIOLET PRODUCTS, INC.
145 Pasadena Ave. South Pasadena, Calif.

Core Drilling
by Contract

Exploration for coal and other mineral deposits. Foundation test boring and grout hole drilling for bridges, dams and all heavy structures.

Core Drill Contractors for more than 60 years

JOY MANUFACTURING CO.
Contract Core Drill Division
MICHIGAN CITY, INDIANA

For Safe, Efficient,
Economical
DRILLING
Specify
SPANG
CABLE TOOLS
"The Higher Standard"

Spang Cable Tools stand out as the top performers in their field for:

- **Shot Hole Drilling**
- **Mineral Exploration**
- **All other types of Cable and Churn Tool Drilling**

Try Spang today!

D322 D312 D342

For Sale by Dealers Everywhere.

SPANG & COMPANY
Butler, Pa.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE
Not available for equipment advertising
$1.20 a line. Minimum 4 lines. To figure advance payment count 5 average words as a line. (See ¶ on Box Numbers.)
EMPLOYMENT WANTED and Individual Selling Opportunity undisplayed rate is one-half of above rate, payable in advance.
PROPOSALS, $1.20 cents a line an insertion.

INFORMATION:
BOX NUMBERS count one additional line in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE
The advertising rate is $9.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request. AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by 10 A.M. April 19th at the New York Office, 330 W. 42nd St., N. Y., will appear in the May issue subject to the limitations of space available.

OPEN PIT MINING

Contractor with excellent equipment and experienced personnel interested in excavating, material handling, or open pit mining work.

CW1319—Engineering & Mining Journal
330 W. 42nd St., New York 18, N. Y.

WANTED

Large engineering firm wishes to acquire several complete plants through purchase of (1) capital stock, (2) assets, (3) machinery and equipment whole or in part. Personnel retained where possible, strictest confidence.

Box 1231, 1474 Broadway, New York 18, N.Y.

SURFACE MINING CONTRACTS WANTED
Contractor desires contracts, no share or percentage proposals, for open pit mining and surface development including access roads in Western United States. Have modern machinery and experienced personnel.

J. HENRY HARRIS
2657—9th St., Berkeley 10, Calif.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

REQUIRED FOR Southwest two experienced draftsmen for design and detailing wood and steel structures, foundation, reinforced concrete and other allied work. Pleasant working conditions. Pension and insurance benefits. Personal traveling expenses refunded. Apply by letter with full details, age, education, experience, etc., to American Smelting and Refining Company, 1112 Mills Building, El Paso, Texas.

GEOLOGISTS, LARGE corporation desires services on permanent basis of several senior geologists, having five to ten years' experience in mineral examination and exploration work. Salary open, commensurate with experience. Please submit complete resume of educational background and professional experience to P 9258, Engineering & Mining Jl.

POSITION WANTED

ENGINEER—WIDE experience mining metallurgical design construction metal and nonmetal. Available for consulting or operation. Foreign service acceptable. PW 8359, Engineering & Mining Jl.

WANTED

Rock Crushing and Milling Manufacturer requires graduate Engineer for production work. Industrial experience in crushing and milling essential. Mechanical aptitude desirable. Applicant to include all details and salary desired in first letter.

P7942, Engineering & Mining Journal
330 West 42nd St., New York 18

DESIGNERS & DRAFTSMEN
With experience in ore dressing plants, smelters and related machinery wanted for permanent positions with active engineering and manufacturing organization. Location: Eastern, Middlewest, West. Salary based on experience. Mail full details of training and experience to

P8623, Engineering & Mining Journal
68 Post St., San Francisco 4, Calif.

CARLYLE

INDUSTRIAL RUBBER PRODUCTS FOR EVERY PURPOSE

IMMEDIATE DELIVERY OF CONVEYOR, ELEVATOR AND TRANSMISSION BELTING — FIRE, WATER, SUCTION, AIR, STEAM AND WELD END HOSE

WHY WAIT

We have 8 to 48

RUBBER CONVEYOR BELTING

TOUGH COVERS—Heavy duty, specially compounded abrasive resistant rubber covers having high tensile strength. Thoroughly capable of withstanding the abrasive action of bulk materials. Properly vulcanized to the carcass to assure utmost performance, economically.

STRONG CARCASS—Constructed of finest quality 28 and 32 ounce tough cotton duck, properly treated and impregnated to avoid mildew from moisture and atmospheric conditions. Each ply thoroughly embedded in rubber to prevent ply separation.

FLEXIBILITY — Careful attention has been given in the construction of all belts to have the proper flexibility assuring the following desirable features: troughs easily, runs true on all idlers, gouge resistant, excellent for long and short hauls and slope installations.

Avoid delays in your production schedules!

We carry in stock for your immediate requirements, Conveyor Belting in widths from 8 inches to 48 inches.

Width	Ply	Thickness Top Cover	Thickness Bottom Cover	Type of Duck Carcass
8"	4	1/16"	1/32"	28 Oz.
10"	4	1/16"	1/32"	28 Oz.
12"	4	1/16"	1/32"	28 Oz.
14"	4	1/16"	1/32"	28 Oz.
16"	4	1/8"	1/32"	28 Oz.
18"	4	1/8"	1/32"	28 Oz.
20"	4	1/8"	1/32"	28 Oz.
20"	5	1/8"	1/32"	28 Oz.
24"	4	1/8"	1/32"	28 Oz.
24"	5	1/8"	1/32"	28 Oz.
26"	5	1/8"	1/32"	28 Oz.
30"	4	1/8"	1/16"	32 Oz.
30"	5	1/8"	1/16"	32 Oz.
30"	8	1/8"	1/16"	32 Oz.
36"	8	1/8"	1/16"	32 Oz.
42"	5	1/8"	1/16"	32 Oz.
48"	8	1/8"	1/16"	32 Oz.

INQUIRE FOR SIZES NOT LISTED. ELEVATOR TRANSMISSION & V-BELTING ALSO IN STOCK.

All our belting made by the leading belting manufacturers.

Write for Free Booklet on Installation, Care & Maintenance of Conveyor Belting.

SEND US YOUR INQUIRIES FOR OTHER RUBBER PRODUCTS

CARLYLE RUBBER CO., Inc.
62-66 Park Place, New York 7, N. Y.
Phone: Digby 9-3810

Rotary Kilns—8½ x 60'—8½ & 9½ x 200'.
Rotary Dryers—3' x 36'—4' x 36'—6' x 48'—8½' x 50'—8½' x 60'—8½ x 70' & 7½ x 70'.
Tube & Ball Mills—6' x 9'—8' x 22'—8½' x 18' 7".
Fuller-Lehigh Mills—22"—42" & 52"—Bradley Mills.
Jaw Crushers—From 10" x 6" up to 36" x 24".
Crushing Rolls—From 16" x 10" up to 72" x 28".
1—Complete Lime Hydrating Plant.
Sturtevant Rotary Ring crushers—No. 0—No. 1—No. 1½ and No. 2
Ring Roll Mills—Sturtevant No. 1—No. 2.
15'—16' & 18' Herreshoff furnaces.
Gyratory Crushers. No. 3 and No 12.
8'—14' air separators.
Magnetic separators—jigs—screens—classifiers and thickeners.
5', 6' & 7' dia. Rod Mills.
Mine Hoists.
8' x 10'—8' x 12'—11½' x 19' Rotary Filters.
One 5 roll Raymond Mill low side, 5 roll high side.

W. P. HEINEKEN
50 Broad Street, New York

For Sale
Brand-New Allis-Chalmers

7'x7' BALL MILL

with 60 cycle motor & controls

Offered subject to prior sale, one Canadian Allis-Chalmers 7' x 7' ball mill, with spurr gear and 6' x 20 texrope pulley. Grate type arranged for Spurr Gear Tevrope drive.

Capacity: ½" feed; grinding 65%-200 mesh 270 tons; 85%-200 mesh 181 tons. Includes Canadian General Electric slip-ring motor, 175 hp, 700 rpm, 440/60/3, complete with base; drum switch control, oil circuit breaker and resistor.

Machine is complete except for lines, countershaft main pinion gear and Texrope drive.

Mill is arranged for grate type but could be changed over to trunnion overflow making a 7' by 7'6" mill.

Has never been set up and is brand new, including the motor.

Price: F.O.B. cars, Vancouver, B.C., is $21,000.00. A reasonable offer will be considered. Approx. Shipping weight is 38,000 lbs.

VANCOUVER SALES & APPRAISALS, LTD.
846 Beach Ave., Vancouver
British Columbia, Canada

TRACTORS — CRANES
LOADERS — SCRAPERS
Rebuilt — Guaranteed

ALLIS-CHALMERS
HD 14 — HD 10 — HD 7 TRACTORS
CATERPILLAR
D 8 TRACTORS
Osgood Model 200
Shovel — Crane half yard
NORTHWEST 80 D
Two and half yard combination
Le Tourneau — Wooldridge — Heil — Garwood
SCRAPERS
LINK BELT MS 70
Cruisercrane (Pneumatic)
ROAD ROLLERS
Tandem & Three Wheel
GRADERS — GALLION 101
New Rubber

IMMEDIATE DELIVERY
Write — Phone — Wire

HYMAN-MICHAELS CO.
2200 Jarrold Ave.
San Francisco 24, Calif.
Telephone Mission 7-3631

For Sale

MILLING MACHINERY & EQUIPMENT

* * * * *

(2) 5' x 18' BALL MILLS

(1) 3' x 5' x 26' DRYER

MOTORS — HAMMERMILLS

DUST COLLECTOR

Miscellaneous Equipment

* * * * *

KENNEDY MINERALS CO., INC.
2550 East Olympic Blvd.
Los Angeles 23, Calif.

Mining company, located in Washington, D.C. will represent a few western mining groups or individuals in negotiations with the D.M.A., or other agencies. Only compensation required is an exchange of non-assessable stock. We have a fine record of performance, but no irregular "inside" contacts.

RA 9045, Engineering & Mining Journal
330 W. 42 St., New York 18, N. Y.

POSITIONS WANTED

EXPERIENCED PROSPECTOR, acquainted with Arizona districts and large copper prospect, seeks salary or travel-bonus deal. Good references. Will take qualifying exam. Have jeep and equipment. Correspondence invited. Address PW 9123, Engineering & Mining Jl.

MINING ENGINEER, since 1936, in posts of senior responsibility, in Canada and Abroad. 23 years of experience: exploration, mine planning and production, haulage—hoisting—crusher plants, mill, smelter. Able to investigate, to soundly define particular and general problems, assist in working out administrative and operational plan to suit considerations. Age 42. Seeking post as project engineer in field or operation. PW 9355, Engineering & Mining Jl.

BUSINESS OPPORTUNITIES

Copper Opportunity for a good mining engineer and investors to develop Idaho Copper mine. New consolidation 3 adjoining copper properties, initial stage development, see smelter returns. Near railroad, power line. Individual ownership no stock. Owner past age of retirement. Reasonable price, liberal terms, exceptional opportunity acquire, organize and put into production. BO 9365, Engineering & Mining Jl.

Lease on Good Terms,
copper property in Colorado. High grade ore, owner will cooperate with responsible party. BO 9248, Engineering & Mining Jl.

For lease—Decoursey Quicksilver
Lode Mine located twenty miles north of Crooked Creek, Alaska post office in the Kuskokwim area. 1500 flasks of mercury produced during past eight years from ore averaging about 2½ flasks per ton. U.S. Geological Survey publication 110855 estimates reserves of 17,000 flasks in low grade ore. 1000 feet of development tunnel with up to 190 feet of backs unmined ore. Lease terms 6% of gross production plus purchase of mine equipment. Bob Lyman, Crooked Creek, Alaska.

Mine properties wanted,
containing strategic minerals, anywhere in the United States or Latin America. W 9405, Engineering & Mining Jl.

PATENTS

Consult: Z. H. Polachek
Reg. Patent Attorney, 1234 Broadway, New York 1, N. Y.

WANTED

BUYERS OF SURPLUS COPPER, INSULATED WIRES AND CABLES
No lengths too long or too short.
Telephone: EAstgate 7-4778
PIERCE CABLE CO.
2674 Clybourn Ave., Chicago 20, Ill.

WANTED
Deepwell Vertical Turbine Pump 600 to 1000 G.P.M. range. 165 to 200 ft. hd. With or without 440 volt A. C. motor.
Battery Motor 2½ to 5 ton 36" gauge with or without batteries & charger.
LITTLE CHIEF COAL CO.
807 W. Walnut St. • Shamokin, Pa.

WANT TO BUY
1—36 x 48 & 1—48 x 60 JAW CRUSHERS
LESTAN CORP.
60 E. 42nd St., New York, N. Y.

DEPENDABLE EQUIPMENT AT A SAVINGS IN TIME AND COST

CONCENTRATING TABLES
2—Wilfley #6 left hand tables.
11—Deister "Plat-O" right hand tables.
6—Deister "Plat-O" left hand tables.

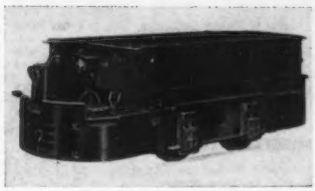
FILTERS
1—4' 1 disc oliver leaf filter.
2—6' 2 disc American leaf filter.
2—8'x12' Eimco drum filters.
1—#12 Sweetland 36 leaf pressure filter press.
1—18" Morse round pattern filter press.

FLOTATION MACHINES
1—#21 Denver Equipment Co. 8 cell flotation machine.
1—#7 new Morse "Jetair" hydra cell.

LOADERS
1—G-D 9 Gardner Denver rocker shovel.
1—#20 Eimco rocker shovel.
2—#20A Goodman "Conway" mucking machines.
4—#50A Goodman "Conway" mucking machines.

BLOWERS
1—#8 H Jeffrey 42" aerodyne fan.
1—6½" x 22¼" Roots rotary blower.
1—8½" x 29¼" Roots rotary blower.
1—10" x 18" new Sutorbilt rotary blower.
1—24" x 78" Roots #7 rotary blower.
3—Buffalo #50 steel plate blowers 3840/7650 CFM.
30—American new type H Volume blowers 1200 CFM motor driven.

SAND PUMPS
1—1" Wilfley Sand Pumps.
4—2" Wilfley Sand Pumps.
1—2" Denver vertical sand pump.
1—3" x 3" Allen Sherman Hoff "Hydro-seal" rubber lined.
1—3" Telluride sand pump.
2—4" Wilfley sand pumps.
1—4" Denver vertical sand pump.
2—6" Wilfley sand pumps.



LOCOMOTIVES
2—2½ ton Mancha battery, 18"-24" gauge.
1—2½ ton Whitcomb battery, 24" gauge.
2—5 ton West. battery, 24"-36" gauge.
2—7 ton Gen. Elect. battery, 36" gauge, permissible type.
2—8 ton Gen. Elect. battery, 36" gauge.
4—10 ton Atlas battery, 36" gauge.
1—6 ton Goodman trolley, 36" gauge.
2—6½ ton Gen. Elect. trolley, 36" gauge.
1—5" x 10" Porter compressed air.
1—5½" x 10" Baldwin compressed air.
1—3 ton Ruth, gas engine driven.
2—18 ton Davenport steam locomotives.

THICKENERS
1—Morse #2 low head thickener mechanism and superstructure for 16' x 8' tank.
1—Dorr 3 tray, 4 compartment thickener, steel tank 40' diameter x 30' high.

AGITATORS
2—Dorr type H agitators for 22' diameter x 14' wood tank.
4—8' x 8' Deveroux type agitators.

ELECTRIC HOISTS
1—#0 Vulcan 11 HP single drum.
1—#1½ Vulcan 22 HP double drum.
1—#22-C Vulcan 35 HP single drum.
2—4½ Vulcan 52 HP single drum.
1—#23-ELF Vulcan 60 HP single drum.
1—60 HP H & B single drum.
1—150 HP single drum hoist.
1—60-100 HP Vulcan single drum.
1—125-165 HP Vulcan single drum.
1—Lidgerwood 3-drum 80 HP contractor's type.

BALL AND ROD MILLS
1—30" x 24" new Morse batch mill.
1—4' x 4' standard ball mill.
2—6' x 36" Hardinge conical ball mills.
2—#64½ Marcy ball mills.
1—6' x 8' Marcy ball mill.
2—8' x 22" Hardinge conical pebble mills.
1—3' x 8' Dewco tube mill.

COMPRESSORS
1—50 CFM S & 4x4" Ingersoll Rand.
1—80 CFM 6" x 5" Worthington.
1—90 CFM 6" x 6" Gardner.
1—139 CFM 8¾" x 4¼" x 5" Chicago-Pneumatic.
1—156 CFM 7" & 5¼" x 5" Gardner-Denver.
1—172 CFM 10½" x 4¾" x 6" Rix.
1—293 CFM 12" & 6½" x 10" Ingersoll-Rand.
1—179 CFM 12" x 10" Ingersoll Rand.
1—317 CFM 7" & 5¼" x 5" Gardner-Denver.
1—382 CFM 9¾" & 5½" x 5½" Chicago-Pneumatic.
1—447 CFM 14" & 7½" x 12" Ingersoll-Rand.
1—528 CFM 14" x 12" Ingersoll Rand.
1—527 CFM 9¾" & 6" x 7" Gardner-Denver.
1—637 CFM 14" & 8¼" x 10" Sullivan.
1—800 CFM 18" & 11" x 16" Ingersoll-Rand.
1—888 CFM 19" & 12" x 16" Ingersoll-Rand.

BETTER MACHINERY — IT'S FULLY RECONDITIONED

ESTABLISHED 1898

MORSE BROS. MACHINERY CO.

P.O. BOX 1708 DENVER, COLORADO, U. S. A. CABLE "MORSE

COMPLETE ORE-MILLING PLANTS — CONCENTRATION · FLOTATION · MACHINERY · CYANIDE · AMALGAMATION

General Office and Plant: 2900 BRIGHTON BLVD., DENVER, COLO.

MILLS — MINING & MILLING MACHINERY

We specialize in mine pumping equipment from 1 foot to 1500 feet. If you need a mine pump, call us. We are equipped to engineer your pumping problems and make delivery NOW.

We build mills or will supply complete mill equipment, mine loading equipment of all kinds, power units, diesel electric plants, electric motors, transformers, belts, pulleys and miscellaneous items, three drum slusher hoists (air or electric), Compressors, portable or stationary, jaw crushers and roll crushers.

SPECIAL

50 K.V.A. 110/220 3 phase 60 cycle portable Diesel generator complete with panel direct connected to 100 H.P. Buda full diesel engine. Like new. Costs today $11,000—Special price $3,250.

Our bargain prices can't be beaten. Write us and compare.

Time payment plan available.

JOPLIN MACHINERY & ELECTRIC COMPANY

420 School Street Joplin, Missouri
Telephone 1500

"A Mining Machinery House run by practical miners".

FOR SALE
Immediate Shipment

1—24" Gauge Battery Locomotive with two 40-cell batteries including all charging equipment.

1—50,000 gallon tower tank, 150 ft. high, all steel spherical bottom, cone roof or top.

2—Reels of new 1⅛" Hazard Brand hoisting cable 6x19 plow steel, hemp center Seal construction, 6,850 ft. in each reel.
We also have a like amount in good used cable.

1—Traylor 8'6"x8' ball mill with 250 HP Synchronous motor, all starting equipment. Steel scoop box, liners, etc.

1—6'x24 Dorr DSFX Heavy Duty Classifier.

1—4'6' Eimco ball mill with Vee drive and motor.

1—Eimco 4' dia. 6' face drum filter, complete with all filtrate and vacuum equipment.
Also Large Hoists, Rock Drills and Fixtures, Fans, Slushers, Feeders, Electric Motors.

1—New Telsmith 36" Gyrasphere Type S Secondary Crusher with grooved pulley.

1—20' dia. x 10' deep Dorr Thickener, complete with redwood tank, overflow launder, low beam superstructure. Late model.

1—Ingersoll Rand Air Compressor, size 22 x 16 and 13 x 16 Duplex Imperial Type 10, complete with endless belt. Short belt idler and 160 HP motor with compensator, necessary piping and large air receiver. Capacity 960 cu. ft. actual at 170 RPM.

MINES ENGINEERING - EQUIPMENT CO.
369 Pine St. San Francisco, Cal.

BOILERS: 1—Erie City 150 H.P., ASME code, HRT 150 lbs. pressure, 4" x 18' tubes, complete with all fittings. Located Pottsville, Pa. 2—Vogt 220 H.P., 3 drum, low head, National Board, 160 lbs. pressure, complete with all fittings. Located Saginaw, Mich.

BUCKET ELEVATORS: 2—Link Belt, boot type, fully enclosed, continuous 82'10", buckets 11¾" deep, 8" projection, 16" wide, on Tesco manganese steel chain. Drawing available. Located Pottsville, Pa.

CAR PULLER: Lidgerwood single drum, 5 H.P., 440 volt, slip ring motor and controls.

COMPRESSOR: Worthington 29 x 21 x 23 with 600 H.P. synchronous motor.

DIESEL MOTOR: 1 — Caterpillar D13000 diesel power unit, 122 H.P., complete with clutch and V belt pulley. Located Saginaw, Mich.

SCREW CONVEYOR: 1—12" x 22 ft. with center bearing, 87 RPM, capacity 30 TPH. Located Pottsville, Pa.

CRUSHERS, GYRATORY: Various makes, size 12" x 44" up to 42" x 134".

CRUSHERS, JAW: Various makes, 3" x 5" to 48" x 60".

CRUSHERS, REDUCTION: Symons 2 ft. and 3 ft., each with standard bowl. Telsmith 2 ft. and 3 ft. Gyrasphere. Traylor 4 ft., type TY.

CRUSHER SPECIALS: 1—Allis Chalmers Superior 30" and one 7½ K, Gyratory. 1—Farrel 18" x 36" Jaw.

DRAG SCRAPERS, CRESCENT BUCKETS: 1—Sauerman 2 yd. Drag Scraper Outfit, complete, without 75 H.P. motor. 1—Sauerman ¾ yd. capacity complete with motor. 1—Sauerman 1 yd. capacity, complete with diesel motor.

NODULIZER: 1—8'6"-10'0"—8'6" x 50 ft.

VIBRATOR FEEDER: Syntron #F55, flat pan trough, 36 x 78".

MINE HOISTS: Single and double drum, 150 H.P. to 2500 H.P.

SHOVELS & DRAGLINES: 1—Bucyrus Erie 120-B, 4 yd. electric Shovel; also, one Bucyrus Erie 170-B, 6½ yd. electric, 3 phase, 60 cycle, 2200 or 4000 volt. 1—Lorain model 57, diesel Shovel, 1¼ yd. capacity. 1—Lima 850 combination Shovel and Dragline, 2 yd., diesel. 1—Lima 1002 Dragline only, 2½ yd. capacity, 80 ft. boom, diesel. 1—Lima 802 Dragline, 2 yd. capacity, powered with GMC diesel, 80 ft. boom, long cats and wide treads. 1—Northwest 95 Dragline, 2½ yd. capacity, 90 ft. boom. 6—Crawler trend, diesel powered Cranes, late type, current models, P & H, Northwest, Lorain, Osgood, 2 yd. and 2½ yd. capacity, with 60 to 80 ft. booms, wide treads and long cats.

A. J. O'NEILL
Lansdowne, Pa.

Phila. Phones: Madison 3-8300 — 3-8301

FOR SALE
Large Stock
New Spare Parts For
Allis-Chalmers Model 322-R Reduction Crusher.
Write for complete list and bargain prices.
ROGER PIERCE EQUIPMENT SALES COMPANY
808 Newhouse Bldg. Salt Lake City, Utah

ELECTRICAL CABLE
- for every industrial and power application.
- Special construction. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular supplies.
- Cut to length. Reasonably priced.

UNIVERSAL Wire and Cable Co.
2674 N. Clybourn Ave. Chicago 14, Ill.

FILTERS — DISC

1—4' 6-disc Eimco, with Vac. Equip. With new Sectors and Bags.

CONCENTRATING TABLES

2—#6 Wilfleys, with rubber deck covering
4—6' x 16' Deister Type

TRANSFORMERS

3—37½KVA Pittsburgh 440-110/220 v.
2—5KVA Wagner 2200-220-1100/110
1—7½KW Pittsburgh 1100/110-2200/230

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One- two cell Pulsator Clean-up Jig. Suitable for use on dredges, mills, and gravel plants. Will handle 120 tons per hour.

New condition and priced to sell.

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F. S. 9466

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Allis-Chalmers Service Does Not Stop When Your Equipment is Installed

YOU SEE, Allis-Chalmers maintains a staff of special repair parts service experts, whose job is to see to it that emergency repair orders are given emergency treatment.

On the alert day and night (they can be reached at home), these men get on the job at once when an emergency call comes through. Working closely with shop management, they locate parts or materials, make sure that shop machinery and machine operators get on the job right away. Most important — *they stay on the job* until the needed part is on its way and actually delivered to you!

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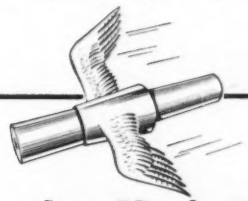
A-3284



New Crusher Shaft Delivered Two Days After Old One Breaks!

FRIDAY P. M.
A gyratory crusher goes down with a broken mainshaft in Watertown, N.Y. plant of General Crushed Stone Company, stopping production.

SATURDAY A. M.
Supt. Bovee, of General Crushed Stone, calls Allis-Chalmers Maintenance and Repair Section, explains predicament. An Allis-Chalmers repair parts expert arranges to follow through at once.

SATURDAY P. M.
New mainshaft and necessary auxiliary parts are rounded up in West Allis-Works (where they are held in readiness for just such an emergency) and leave A-C yards at 6:25 p.m. Saturday. Meanwhile, Allis-Chalmers Traffic department is able to speed shipment by making a route change at Chicago, saving 48 hours. Repair parts man calls Supt. Bovee, tells him shipment will arrive Syracuse, N.Y. 6:30 p.m. Sunday, and supplies car number.

SUNDAY P. M.
Truck is waiting at Syracuse to take shipment direct to Watertown, N.Y.

MONDAY
Crew works Sunday night and Monday completing installation of new mainshaft and parts. Plant is back in operation first thing Tuesday morning. (Monday was a holiday, so hardly any time was lost at all.)

SERVICE LIKE THIS *is not exceptional when emergencies exist. It's typical of the repair parts service you can expect after your Allis-Chalmers machinery has been installed. Allis-Chalmers, Milwaukee 1, Wisconsin.*

Allis-Chalmers will be glad to recommend spare parts for your equipment — the best protection you have against shut-downs!

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Sales Offices in Principal Cities in the U. S. A. Distributors Located Throughout the World.

Your hauling costs can be cut!

Here are 8 big reasons why TIMKEN® bearings cut your costs of hauling coal and ore

1. GREATER RESISTANCE TO SHOCK LOADS. Timken tapered roller bearings are made of Timken® fine alloy steel and case-hardened to provide a hard, wear-resistant surface and a tough, shock-resistant core. On over 500,000 mine cars Timken bearings have proved they can take the shock loads in their stride and insure trouble-free mine car performance.

2. GREATER CAPACITY. Loads are carried on a *line* of contact between rollers and races.

3. EASY STARTING, LONGER TRAIN LENGTHS. True rolling motion of Timken bearings reduces friction, permits easy starting and more cars per train.

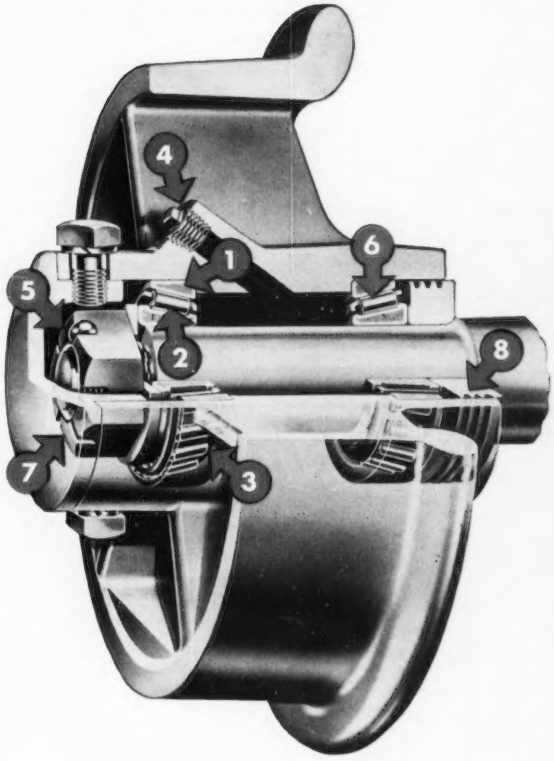
4. PERIODIC LUBRICATION. No matter what kind of bearings you use, periodic lubrication will lengthen their life, reduce your costs. Replacing old, dirty, moisture-laden grease with fresh, live, protective grease is cheap insurance for trouble-free car operation.

5. INSPECTION SIMPLIFIED. Wheels can be easily removed for bearing inspection by simply pulling the cap, cotter pin and nut.

6. CARS TAKE CURVES EASIER because Timken tapered roller bearings take both radial and thrust loads in any combination. No special thrust plates or bearings needed.

7. ADJUSTABLE FEATURE INCREASES BEARING LIFE. Timken bearings in well-maintained cars show practically no wear. However, if some wear should occur after long years of service, the resulting bearing looseness can be removed simply by tightening the nut.

8. DUST COLLAR PROTECTS LUBRICANT. And it increases the effectiveness of periodic lubrication by permitting old grease to be flushed from the bearings when new lubricant is added.



Specify Timken roller bearings for *your* mine cars and assure yourself of all these cost-saving advantages. Call in our mine car bearing experts today and let them show you how your hauling costs *can* be cut! The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

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NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⓘ AND THRUST —ⓘ— LOADS OR ANY COMBINATION —ⓘ—